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TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1928 1930

No. 501 3

POWERS-KENNEDY CONTRACTING CORPORATION AND ANTHONY G. FLECK, PETITIONERS,

vs.

CONCRETE MIXING AND CONVEYING COMPANY

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SECOND CIRCUIT

PETITION FOR CERTIORARI FILED OCTOBER 15, 1928

CERTIORARI GRANTED DECEMBER 10, 1928

(33,810)

(33,810)

SUPREME COURT OF THE UNITED STATES

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[fol. 1]

IN UNITED STATES DISTRICT COURT, SOUTHERN DISTRICT OF NEW YORK

In Equity

CONCRETE MIXING AND CONVEYING COMPANY, Plaintiff,

vs.

POWERS-KENNEDY CONTRACTING CORPORATION and ANTHONY G. FLECK, Defendants

BILL OF COMPLAINT

Plaintiff, for complaint against defendant, alleges as follows:

(1) Plaintiff, Concrete Mixing and Conveying Company, is a corporation organized and existing under and by virtue of the laws of the State of Illinois, having its principal place of business at Chicago, in the County of Cook and State of Illinois. Defendant, Powers-Kennedy Contracting Corporation, is a corporation organized and existing under and by virtue of the laws of the State of New York, having its principal place of business at 149 Broadway, New York City, in the State of New York, and defendant, Anthony G. Fleck, is a citizen of the State of New York and has a regular and established place of business in the Borough of Manhattan, within the Southern District of New York, [fol. 2] within which district both defendants have committed acts of infringement of plaintiff's patent, of which complaint is made herein.

(2) John H. McMichael being, prior to January 14, 1907, the original, first and sole inventor of certain new and useful improvements in method of and apparatus for transporting and treating concrete, lawfully filed and prosecuted an application for United States Letters Patent therefor, and having complied in all respects with the statutes, United States Patent No. 1, 127,660 was lawfully granted and issued pursuant to said application to the plaintiff on February 9, 1915.

Said invention was new and useful, not known or used by others in this country before his invention thereof, not patented or described in any printed publication anywhere before his invention or more than two years prior to said application for United States Patent therefor, not in public use or on sale in the United States for more than two years prior to said application for United States Letters Patent therefor, not patented in any foreign country by him or his legal representatives on an application filed more than one year before his said application for United States Letters Patent, and not abandoned. Said United States Letters Patent No. 1,127,660 is now in full force and is hereby proffered and ready to be produced before the Court.

(3) The invention patented in the aforesaid patent No. 1,127,660 is of great utility and has been introduced into public use by the plaintiff, and the public generally has [fol. 3] acquiesced in and acknowledged the utility of said invention, and the validity of said Letters Patent, and the plaintiff's exclusive rights thereunder.

(4) Plaintiff is and always has been the sole owner of said United States Letters Patent No. 1,127,660 and of all rights of action for infringement thereof.

(5) In violation of plaintiff's rights under said United States Letters Patent No. 1,127,660, and without any authority, since the issuance of said patent and within six years prior to the commencement of this suit within the Southern District of New York, and elsewhere in the United States, defendants have jointly and severally infringed plaintiff's exclusive rights granted by said patent by making and (or) using and (or) selling the patented apparatus for transporting and treating concrete, an instance thereof being in the construction of the Queensborough subway extension, in the Borough of Manhattan, City of New York, State of New York, the said infringing machines having been made and (or) caused to be made and (or) used by the defendant Fleck on the said work for the defendant corporation and the said two defendants having conspired together and co-operated in the committing of said infringement. Defendants continue to make and (or) use and (or) sell the apparatus embodying the patented invention in violation of plaintiff's rights, and in infringement of said

patent, whereby plaintiff has been and is greatly and irreparably damaged, and whereby defendants have obtained [fol. 4] and are obtaining large profits which in equity belong to the plaintiff, the amount of which damages and profits the plaintiff cannot ascertain except by an accounting.

Plaintiff therefore prays:

(a) That defendants be required to answer this bill of complaint, but not under oath, answer under oath being hereby expressly waived.

(b) That the court grant a preliminary injunction pending this suit and a perpetual injunction restraining defendants, its officers, and their joint and several agents, employes and confederates from making, using or vending devices embodying said patented invention, and from offering or advertising so to do, and from aiding or abetting or in any way contributing to the infringement of said patent.

(c) That this cause be referred to a Master to make and report on account of damages and profits accruing from defendants' infringement of said patent, and that the damages reported be increased threefold in view of the wanton character of defendants' infringement, and that plaintiff have judgment for the damages and profits so found and for the costs of this suit.

(d) That plaintiff have such other and further relief as equity may require.

Concrete Mixing and Conveying Company. (Signed)
Edward Wray, President.

[fol. 5] In United States District Court

Answer

Answering the complaint herein, the defendants, the Powers-Kennedy Contracting Corporation, and Anthony G. Fleck, severally and jointly say:

A. They have no knowledge or belief that the plaintiff is a corporation as alleged in paragraph 1 of the complaint, or that it is the sole owner of the McMichael patent No.

1,127,660 or of any or all rights of action for infringement thereof as alleged in paragraph 4 of the complaint.

B. They admit the allegations in the second sentence of paragraph 1 of the complaint except that they deny they have committed any acts of infringement of said patent.

C. They admit that patent No. 1,127,660 was granted on February 9th, 1915, and that John H. McMichael on January 14, 1907, filed an application for a patent, but they deny that said patent was issued lawfully pursuant to said application, or that said McMichael was prior to January 14, 1907, the original, first and sole inventor of any new or useful improvement set forth in said application, or that he had then or during its prosecution did comply in all respects with the Statutes.

D. On information and belief, they deny, save as aforesaid, each allegation in paragraph 3 and in the second section of paragraph 2; and allege specifically that said inven- [fol. 6] tion was not new and not useful, that it was known or used by others in this country before John H. McMichael's alleged invention thereof, that it was patented or described in printed publications before his alleged invention and more than two years prior to his said application for United States Patent therefor, that it was in public use or on sale in the United States for more than two years prior to his said application for United States Letters Patent therefor, that it was patented in a foreign country by him or his legal representatives on an application filed more than one year before his said application for United States Letters Patent, that it was abandoned; that said United States Letters Patent No. 1,127,660 is not now in full force; that the alleged invention patented in the aforesaid patent No. 1,127,660 is of no utility and has not been introduced into public use by the plaintiff, and that the public generally have not acquiesced in or acknowledged the utility of said invention, or in the validity of said Letters Patent, or in the plaintiff's alleged exclusive rights thereunder.

E. They deny each allegation in paragraph 3 of the complaint and deny specifically that in violation of plaintiff's rights under said United States Letters Patent No. 1,127,660, and without any authority, since the issuance of said patent and within six years prior to the commencement of

this suit within the Southern District of New York, and elsewhere in the United States, (they) defendants have jointly and severally infringed plaintiff's exclusive rights granted by said patent by making and (or) using and (or) [fol. 7] selling the patented apparatus for transporting and treating concrete; and they expressly deny that they have, are, or intend to commit any act of infringement in the construction of the Queensborough subway extension in the City of New York, Borough of Manhattan, and State of New York; and they deny that the said infringing machines having ben made and (or) caused to be made and (or) used by the defendant Fleck on the said work for the defendant corporation and the said two defendants having conspired together and co-operated in the committing of the said infringement; and they deny that they continue to make and (or) use and (or) sell the apparatus embodying the patented invention in violation of plaintiff's rights, and in infringement of said patent, and deny that plaintiff has been and is being greatly and irreparably damaged, and deny that defendants have obtained and are obtaining large profits which in equity belong to plaintiff.

F. On information and belief, they allege that all such apparatus as they may have made, used or sold, either jointly or severally, is beyond any reasonable interpretation of said patent, and that said apparatus, except wherein it represents the conventional skill of the art prior to the alleged McMichael invention, is altogether different in structure and function from anything covered by said patent.

G. On information and belief, they allege that the apparatus set forth in said patent involved nothing more than the exercise of the expected skill of the art prior to the Mc- [fol. 8] Michael alleged invention; and they allege that said patent is invalid and anticipated fully by prior patents and publications as follows:

Inventor	Number	Date
S. W. Wood	65,149	May 28, 1867
L. La Rue Smith	268,305	Nov. 28, 1882
J. W. Beach	267,318	Nov. 14, 1882
J. B. Hyde	274,778	Mar. 27, 1883
L. Smith	279,034	June 5, 1883

Inventor	Number	Date
J. Lewis	285,047	Sept. 18, 1883
J. G. Pohle	347,196	Aug. 10, 1886
J. S. Wallace	408,201	Jul. 30, 1889
M. B. Church	487,606	Dec. 6, 1892
G. G. and H. N. Gray	477,361	June 21, 1892
A. Bryce	520,766	June 5, 1894
J. E. Mathewson	531,379	Dec. 25, 1894
A. Bryce	561,482	June 2, 1896
S. C. Davidson	599,055	Feb. 15, 1898
C. T. Hennig	609,744	Aug. 23, 1898
E. A. Franklin	634,524	Oct. 10, 1899
H. G. Warren	671,303	Apr. 2, 1901
W. Goldie	676,128	June 11, 1901
J. C. Hooper	704,037	Jul. 8, 1902
W. Goldie	707,840	Aug. 26, 1902
L. H. Davis	730,884	June 16, 1903
H. Cutting	773,852	Nov. 1, 1904
M. A. DeFrance	741,116	Oct. 13, 1903
N. Farnham	747,396	Dec. 22, 1903
G. M. Schwend	752,598	Feb. 16, 1904
F. Sticker	758,118	Apr. 26, 1904
G. Rosenthal	759,750	May 10, 1904
J. D. Murray	783,218	Feb. 21, 1905
J. D. Murray	773,665	Nov. 1, 1904
F. W. Breidster	791,176	May 30, 1905
[fol. 9] H. H. Hahn	808,236	Dec. 26, 1905
A. Q. Nash	830,518	Sept. 11, 1906
W. H. Kelly	839,483	Dec. 25, 1906
E. Phillips	837,113	Nov. 27, 1906
J. D. James	837,622	Dec. 4, 1906
F. M. Wise	847,270	Mar. 12, 1907
W. H. Kelly	864,471	Aug. 27, 1907
W. L. Canniff	873,345	Dec. 10, 1907
J. W. Buzzell & Larkin	894,813	Aug. 4, 1908
W. McIlvrid	958,421	May 17, 1910
F. S. Lamson	1,249,290	Dec. 4, 1917
Gauthir	386,121	
Prindle	179,055	
	23,594	(British) 1896
	12,758	(British) 1894
	18,394	(German)

Knight's Mechanical Dictionary Vol. 1 (1874), page 775. Title: Ejector.

Knight's Mechanical Dictionary Vol. 2 (1875), page 1186. Title: Injector.

New American Mechanical Dictionary Knight 1882, page 52. Title: Aspirator.

H. They further allege, on information and belief, that said alleged invention was in public use and on sale in the United States more than two years before said John H. McMichael made application for patent covering the same, and that the patentees named in the next preceding paragraph had knowledge of such public use and sale, the names and addresses of such persons being fully set out in said Letters Patent cited by way of anticipation.

[fol. 10] I. They allege on information and belief that said complaint (when taken in connection with said patent in suit No. 1,127,660, and also in connection with the file-wrapper and contents of said patent, the same being a documentary history of the prosecution of said patent in the U. S. Patent Office) fails to state facts sufficient to constitute a valid cause of action in equity for the following reasons:

(a) Because the patentee of the patent in suit abandoned the invention as originally filed in that he submitted to rejections of claims as originally filed and as amended, and cannot now be heard to set up other or further claims which are inconsistent with his original disclosure of invention, or with such abandonment;

(b) Because new matter was introduced into the specification and claims which was inconsistent with the original disclosure and beyond the scope of the original oath made in connection with the original application; and that therefore the claims as allowed are not supported by an oath as required by the United States Statutes in such case made and provided;

(c) Because the plaintiff became estopped to deny the invalidity of the claims of the patent by reason of the acts of the patentee in the course of the prosecution of said application for patent;

(d) Because the statement on the face of the patent with reference to the prior state of the art, between lines 29-50 inclusive, page 4, and the statement on page 3, lines 95-103 inclusive, amounts to such disclaimer of invention on the [fol. 11] part of the inventor as to negative any right to the inventions claimed in the patent in suit, or in those claims upon which infringement is specifically alleged;

(e) Because the renewal of said application (which is alleged to have been accomplished as of the date of January 23, 1911) was not accomplished according to the requirements of Rules 172, 175 and 176 of the Rules of Practice of the U. S. Patent Office, or according to the requirements of the Revised Statutes of the United States, Sections 4894 and 4897; and because said application was abandoned for failure to complete or prosecute the same, and because the said applicant did not show facts sufficient to justify such renewal, and failed to show that his delay in such application was unavoidable, and because the said application before renewal was not made within two years after the allowance of the original application, and did not bear date of the time of the renewal, and was not subject to examination like an original application.

Wherefore, these defendants humbly pray that the complaint be dismissed with costs and disbursements.

Powers-Kennedy Contracting Corporation, by —— Bingham, Vice President. Anthony G. Fleck, Albert F. Nathan, Solicitor and of Counsel for Defendants.

[fol. 12] *Duly sworn to by Bingham and Anthony G. Fleck. Jurat omitted in printing.*

[fol. 13] In United States District Court

Order Amending Answer

This cause coming on to be heard in open court on the regular motion calendar, June 15, 1926, on the motion of defendants to amend their answer, and John D. Morgan, Esq., and Allan M. Johnson, Esq., appearing for the de-

fendants, and Stephen J. Cox, Esq., appearing for the plaintiff, and the Court being fully advised of the amendments sought to be made to the answer of the defendants heretofore filed in this case, it is:

Ordered Adjudged and Decreed, that the motion be granted and that the following amendments be allowed, and the Clerk of the Court is hereby ordered to file the same as the date of this order as an amendment to the original answer:

On page 5 at the end of paragraph "G" insert:
W. H. Smith, 122,497, Jan. 2, 1872.
W. H. Smith, 122,498, Jan. 2, 1872.

[fol. 14] On page 5 at the end of paragraph "H" insert the following:

They further allege that said alleged invention was in public use in the United States more than two years before said John H. McMichael made application for said patent on January 14, 1907, to wit:

(1) In 1900 by William Artingstall, civil and licensed structural engineer, with offices at 1206 Union Trust Building, Chicago, Illinois, and Haley-Ward Company of Watertown, New York, in the construction of a head race or water channel near Black Rock, New York, which is near Watertown, N. Y.

(2) In 1903 by Jackson & Corbett Bridge & Steel Works of Chicago, Illinois, and George W. Jackson and John T. Fanning in laying a concrete floor and underpinning at 177 East Monroe Street (old number) City of Chicago, Illinois.

(3) In 1901, latter part of the year, by the Jackson & Corbett Bridge & Steel Works of Chicago, Illinois, Geo. W. Jackson and John T. Fanning, in the Illinois Tunnel Company's tunnel in Chicago, Illinois, adjacent the Powers & O'Brien shaft, Shaft No. 1.

(4) In 1902 and 1903, and later, with different machines, by the same parties in the Illinois Tunnel Company's tunnel in Chicago, Illinois, adjacent the Powers & O'Brien shaft, Shaft No. 1.

It is further ordered, adjudged and decreed that if this case can be heard this term no bond need be filed. If, how-
[fol. 15] ever, the case cannot be heard this term, and goes over to the Fall term, then the granting of this order to amend is subject to the defendants filing a bond for five thousand ($5,000) dollars, in favor of the plaintiff, to cover any possible judgment that may be finally entered in its favor for infringement of the patent in suit.

John C. Knox, U. S. District Judge.

New York, N. Y., June 16, 1926.

The entry of the foregoing order is consented to.

Stephen J. Cox, Attorney for Plaintiff.

New York, June 16, 1926.

In United States District Court

Memorandum—Filed June 21, 1926

It appearing that the present Equity term of the court will end June 25, 1926, I have signed the within order. Obviously the plaintiff cannot investigate the new defense sought to be interposed within ten days. The case should therefore go over until Fall as the delay has been occasioned by the new defense. I think the suggested bond should now be filed. Over the Summer, however, plaintiff must make its investigation of the new defense and be prepared for trial in October.

Jno. C. Knox, U. S. D. J.

[fol. 16] In United States District Court

Plaintiff's Interrogatories

And now comes the plaintiff and moves the Court for leave to file the following interrogatories, to be answered by the defendant Anthony G. Fleck under oath, and gives notice that the same will be presented to the Court, and this motion for leave to file the same and for an order directing

the defendant to answer them, on Friday, February 27th, 1925, at 10 o'clock A. M. or as soon as the matter can be heard, at the session for the hearing of motions to be held on that date in the Court Room in the Federal Building, of the Borough of Manhattan, City of New York.

1. Do not the annexed pages from the Magazine as the Engineering News-Record published and circulated in the United States and being pages 264-268 of a copy of the number of said Magazine published February 12, 1925, correctly describe and illustrate the work now being carried on and carried on since the grant of the patent in suit and prior to the commencement of this suit by the defendants in the Southern District of New York, as stated therein?

2. Does not the said article correctly describe and illustrate the work carried on by the defendants at the time and place stated in the last question under the heading "Placing Concrete"?

3. Is not the statement of the said article under the heading "Personnel" a correct statement of facts?

[fol. 17] 4. Are not the same things set forth in the last three questions true also of the article published and circulated in the United States in the Compressed Air Magazine of June 1924, of which a copy is hereto annexed, and particularly the description and illustrations on pages 901 and 902, the description beginning with the words "The placing of concrete" on page 902?

5. Was not the pneumatic concrete conveying and placing device illustrated in Figure 12 of the Engineering News-Record article and in the bottom illustration of page 901 of the Compressed Air Magazine article constructed and operated as follows:

Concrete was dumped into the drum or vessel D through its top and the top closed. The compressed air was then admitted to the top of said vessel and above the mass of concrete therein at A and air pressure thus established behind the said mass tending to force it down over the smooth walls of the funnel shaped lower part B and through the outlet E of said vessel to and through the extending conduit or passageway C to the forms, and compressed air was also

admitted to the outlet through the nozzle F and into the moving concrete.

"5a. If the answer to interrogatory 5 is not wholly affirmative, state exactly how the said pneumatic concrete conveying and placing device was operated and what variations, if any, in its operation were practiced to your knowledge?"

6. Was not the said machine for conveying and placing concrete pneumatically built for the defendant, Power- [fol. 18] Kennedy Contracting Corporation under the direction of the defendant, Anthony G. Fleck since the grant of the patent in suit and prior to the commencement of this suit?

7. Was not the said machine installed on the said job for the said corporate defendant under the direction of the said defendant Fleck?

8. Was not the said machine placed in operation on the said job under the direction of the said defendant Fleck for the said corporate defendant?

9. Was not the said machine actually operated on the said job by the defendant Fleck for the said corporate defendant and did he not advise and instruct others in the employ of the said corporate defendant in the use and operation of the said apparatus?

10. Which of the forty-eight patents and publications set up in the answer of the defendants herein will be used by the defendants at the hearing in support of the allegations of the answer that the patent in suit is anticipated?

11. Which of the forty-eight patents and publications set up in the answer of the defendants herein will be used by the defendants at the hearing in support of the allegations of the answer that the patent in suit is lacking in invention? [fol. 19] The foregoing interrogatories are propounded for the discovery by the opposite parties of facts material to the support of the cause, and the defendant Anthony G. Fleck is required to answer each and all of them, on behalf of defendants. In case he is not able to answer any of the said interrogatories or is not able to answer any of them fully, then John J. Kennedy, Treasurer and General Mana-

ger of the corporate defendant and Henry L. Kennedy, General Superintendent of the said corporate defendant are required to answer the same and to answer them fully; and motion is hereby made for an order allowing the plaintiff to file each and all of said interrogatories to be answered by the said officers of the corporation and directing the said officers to answer the same.

And in case of the failure or refusal of the defendant Fleck, or the said officers to answer the said interrogatories fully, or such of them as may be allowed by the court, the plaintiff will ask the court for an order for the examination of such officers upon such interrogatories, and for such other and further relief as to the Court may seem just in the premises.

Dated February 21, 1925.

Stephen J. Cox, Plaintiff's Solicitor, 233 Broadway, New York City.

To Albert F. Nathan, Esq., Defendants' Solicitor, 149 Broadway, New York, N. Y.

[fol. 20] Open Cut and Tunnel in Manhattan Schist

Queensborough Cross-town Subway Extension at Forty-Second St., Manhattan, Calls for Careful Methods in Safeguarding Crossing Tunnels and Water Mains

Underground railway construction in its most difficult aspects is illustrated by the work now well advanced on the Queensborough Subway extension across-town at 42nd St., in New York. Abutting buildings, contiguous water mains and sewers and other subways running above or across introduce exceptional hazards while heavy rork excavation and the erection of steelwork and concrete placing below busy streets without hindrance to traffic or annoyance to business demand the construction in detail which characterizes subway building under city streets. It is as a series of special operations, therefore, that the new cross-town rapid transit line has to be considered.

Route and General Plan.—The route of the new subway is shown in diagram by Fig. 1. The Queensborough subway from Long Island crossing the East River on the line

of 42nd St., Manhattan, terminates at Vanderbilt Ave. Its train terminal is the Park Ave. and Grand Central Subway Station. From here, west across-town to the Broadway and the Seventh Ave. Subway Station at Times Square, the transfer of passengers has been by shuttle trains accom-odated by taking over the 42nd St. spur of the Seventh Ave. Subway. This shuttle train service has grown inadequate and besides it requires a change of trains. The new [fol. 21] line is intended to relieve the congestion and delay by providing a parallel cross-town route. It is an extension west of the Queensborough subway which provides through train service between Times Square Station (Seventh Ave. and Broadway) and Queensborough. The traffic services of the new line need not be further indicated except to observe that there is an intermediate station (between Times Square and Grand Central) at Fifth Ave.

Turning to the map, Fig. 1, the route, stations and sequence of open-cut and tunnel construction are clearly indicated. In detail the construction required is as follows: From the old Steinway tunnels terminal, 74 ft. below street grade, twin tunnels on a rising grade extend to a little west of Fifth Ave. From the ends of the twin tunnels west something over 500 ft. is open-cut emplacement for the Fifth Ave. Station. Here the depth to subgrade is about 45 ft. Then comes double-track tunnel under the corner of Bryant Park and Sixth Ave. and along 41st St. to near Broadway. An open-cut station excavation carries the work to about midway between Seventh and Eighth Avenues. Thence, to a dead end at about the middle of Eighth Ave., is double-track tunnel. At Seventh Ave. the depth is about 55 ft. There are in tunnel and open-cut 226,000 cu. yd. of excavation of which 189,000 cu. yd. are rock. The total length of the line is 3,660 ft.

From the outline of the work, it will be observed that subways cross over the new line on Seventh Ave. and on Broadway and for the distance that the new line is within 42nd St. Where the line skirts the Public Library building [fol. 22] and in 41st St., where it fills the street between curbs, there are contiguous building foundations to be considered. Crossing sewers and water mains furnish a third type of hazard. The ways of meeting the hazard in each case indicate general procedure also.

Sewer and Pipe Crossings.—The most important conduit crossings under-run by the subway have been a 6-ft. sewer between Vanderbilt and Fifth avenues and four lines of 48-in. water mains at Fifth Ave. In the case of the sewer the cover over the excavation to the bottom of the sewer was 4 ft. There was a 10-ft. cover between excavation and the water mains. Somewhat different methods of driving underneath were adopted in the two cases, both however based on the theory of close shallow holes and light blasts.

Under the sewer the construction was parallel twin tunnels, with a separating rock core and inside structures of steel bents with concrete arches between them. The cut for each tunnel was 16½ x 17 ft. It was normally taken out in a heading about 20 ft. ahead of the bench and in a bench 7 to 9 ft. high. On approaching the sewer short holes were put in close together and light charges were fired. This broke out the rock in small pieces and reduced the blasting shock and shattering to insignificant amounts. Moreover the bench was kept close to the heading and the lining was kept snug up to both.

In case of the water mains in Fifth Ave. and a bottom heading 9 x 8 ft. was driven and enlarged. Using many short holes the sides of the heading were widened and the roof was raised by many small blasts. The dynamite was [fol. 23] 60 per cent. Virtually the roof rock was peeled off in layers. This procedure with a 10-ft. cover hardly shook the water mains. It should be noted, however, that in case of both sewer and mains the underlying schist rock was hard, dense and solid.

Besides the mains there had to be passed, on the west side of Bryant Park, a shaft to the pressure tunnel under Manhattan of the Catskill adequate system. Both shaft and tunnel are filled with water under pressure. From the side of the tunnel to the side of the shaft was 30 ft. Ordinarily in the heading 26 to 28 holes were used. In passing the water shaft the number was increased to 126 largely on the side and crown nearer the shaft. The heading on one side was in effect line drilled and wedged out by light blasts.

Subway Crossings.—Illustrating, even better, blasting in detail as a means of under-running other structures, are the Seventh Ave. and the Broadway subway crossings and the shuttle line on 42nd St. east of Fifth Ave. Con-

sidering first the direct crossings as the more simple, the general under-crossing procedure has been developed as indicated in diagram by Fig. 2.

At the crossing the roof of the new tunnel is up against the floor of the old tunnel. As the side wall of the old tunnel is approached the rock is removed for the insertion of plate girder *A* spanning the new cut and carrying the side wall of the old subway. Then entrance is made to the old subway and beams *a* and *b* are set under the rails and spanning the new cut, and are encased in concrete. Driving is then begun using many holes and light charges until [fol. 24] the face is removed so that columns 1*a* can be erected and the lining placed. Driving ahead, columns 2*b* are put in. Then beams *c* and *d* are installed and driving and lining proceed until track II is supported. By the same process tracks III and IV are under-run.

In 42nd St. the relation of the new subway to the shuttle line above is shown by Figs. 3 and 4. Here the new structure is parallel twin tunnels. As shown by Fig. 5, a bottom heading driven from both ends was put through in each tunnel. Then the roof was raised by close, shallow holes and light blasts keeping the lining structure erected close up to the face. The illustration indicates the character of the rock which here is dense, solid and hard. Construction has proceeded past the point of thinnest cover between the new subway roof and the old subway floor and from this point on the cover will thicken. It is, however, considered by the engineers of the Board of Transportation that to proceed by this method introduces too great a hazard to the operating subway and excavation has been ordered stopped, although the contractors, with a large bond to guarantee security, had so arranged the work that with a 4-ft. solid rock lintel, overhead, the superimposed load of the old subway columns would in no case be more than 15 in. from direct support beneath. The contractors have acceded to the engineers' demand, but presumably will require compensation for the resulting delay and extra expense.

In the cut for the Broadway-Seventh Ave. station the street had to be kept free for traffic. Plate girders were [fol. 25] used to span the cut. They were held up at the ends by posts standing on the rock, and carried a timber

flooring. As at the Fifth Ave. cut, the plan was to keep the cut as free as possible from timbering. In general this is the outstanding feature of all the work, tunneling as well as open cut.

Driving Tunnel.—Where the excavation is two parallel tunnels east of Fifth Ave.—a top heading of about half of the 16½ x 17-ft. section was driven using 53 holes 2 ft. deep. A shot took out 6 or 7 ft. The bench was kept 20 ft. behind the heading. The drills were 2¼ in. to 1⅝ in., with ⅛-in. drop for each change of steel. A heading round required about 65 steels and a bench round required 20 steels. As has been described this normal practice was changed when under-running conduits and subways.

Under Bryant Park and 41st St. the tunnel was largely umbrella section—that is, two arches carried on center and side walls. Generally the rock was hard, although seamed, but in one place for some distance it was rotten. There have been variations in detail but in general the process has been to drive a top heading, Fig. 9, and then deepend it to form a center cut, Fig. 10. In this center cut the forms for the center wall and its umbrella top were erected, Fig. 11 and filled. Widening out then began in such manner that the roof arches could be put in resting on rock benches at the sides. Finally the rock benches were taken out and replaced with concrete, thus completing the side walls. The method cut down timbering, gave quick permanent roof support and left the space below the roof re- [fol. 26] markably clear for hauling and other work. It was adopted as a particularly safe method in uncertain rock.

Placing Concrete.—All concrete has been placed by compressed air. This process has been found by the contractors to have particular merit. The pipe line takes up little room and it can be nosed into almost any space to be filled, even close up to the excavation. Examination and test show the concrete to be dense and uniform. The delivery in small batches is peculiarly adapted to concreting generally small-volume units.

Three concreting plants have been operated, two of 1/3-cu. yd. and one of 1/6-cu. yd. batch capacity. All are located in the excavation and the arrangement is alike for

all. At the sheet surface there is a hopper into which trucks dump sand and stone. The hopper delivers the aggregate into a sand bin or a stone bin below the surface. These bins have side gates which deliver into a measuring hopper. Cement chuted in bags from the street surface comes to the measuring hopper platform and is there added to the stone and sand batch. The measuring hopper empties into the mixer on a staging beneath. In turn the mixer discharges into a hopper and closed chute to the body of the compressed air concrete gun.

Essentially the gun, as shown by Fig. 12, is a conical drum with charging and discharge connections and with valves and air connections. When charged with concrete the proper valves are operated, air is turned on and the batch is forced out of the drum and driven through the discharge pipe line to the point of deposit. In the subway operations the air pressure has ranged from 65 to 80 lb. [fol. 27] It has been possible to shoot a batch a minute. With the three outfits 160 cu. yd. of concrete have been placed in a shift. A 6-in. discharge pipe line has been used in all instances. The maximum delivery which the work will require is 1,500 ft. So far one of the larger guns has delivered through 1,160 ft. of pipe, with nine right-angle bends, to a height of 57 ft. above the drum. At the end there was a vertical lift of 24 ft. It will be noted that the gun is not depended on for any mixing action, it is simply a device for delivering concrete already mixed in the regulation manner.

Power Plan.—Compressed air is furnished by a plant on the East River front at about 42nd St. There are two electrically driven compressors, one direct-connected 14 and 22 in. x 20 in. with a capacity of 1,600 cu. ft. of free air per minute and one belt-connected 10 and 16 in. x 14 in. with a capacity of 660 cu. ft. at 80 lb. These compressors operate the drills, pneumatic tools, concrete guns, hoists and pumps. The mixers are motor-operated.

Personnel.—Contract for construction was awarded April 21, 1922, to the Powers-Kennedy Contracting Corporation of New York, A. J. Powers, president, John J. Kennedy, treasurer and general manager, and Henry L. Kennedy, general superintendent. Albert Carr was engineer for the contractor during the early part of the work and on his

death Henry B. Seaman was engaged. The direction of the work is under the Board of Transportation, Robert Ridgway, chief engineer.

[fol. 28] Constructing a Difficult Subway with Consummate Skill

Work on Queensborough Subway Extension in New York City Going Steadily Forward

By A. S. Taylor

The placing of concrete forms one of the most interesting features of this great undertaking, and the means employed by the contractors to do this are deserving of special mention. Compressed air has proved a prime aid in operating the facilities utilized in speeding up this part of the job. The pneumatic placing of concrete is not, in itself, a novelty; but conditions in the case of the Queensborough Subway Extension have called for apparatus which would be sufficiently flexible to deal with the continually changing demands.

Three concrete placers or "shooters," as they are called by the men on the work, are in service. Two of these are capable of shooting a third of a cubic yard of concrete at a time, while the capacity of the smaller outfit is one-sixth of a cubic yard. The placers were built by the Pneumatic Concrete Machinery Company and have been adapted by the contractor to meet his particular needs. One of the larger shooters has delivered concrete a total distance of 1,160 feet, sending the batch through a 6-inch line in which there were nine 90-degree turns. The material mounted a total of 67 feet on the journey—24 feet of which was a straight rise at the end of the run. As Mr. John J. Kennedy has expressed it: "One hundred per cent of the stuff that goes into the mixer is shot into the forms, no matter how far the forms are away from the shooter."

[fol. 29] The air pressures used have ranged from 65 to 80 pounds per square inch; and it has been possible to shoot a batch a minute with each of the outfits. In a day the three shooters have placed 157 cubic yards of concrete; and they have made it feasible to erect steel-work and to complete concreting close up to the advancing headings. In short, concreting has been done where it could not be

placed by hand; and the machines have produced better and more finished jobs.

In United States District Court

Answer to Plaintiff's Interrogatories

The defendant, Powers-Kennedy Contracting Corporation by John Kennedy, treasurer and general manager, answers plaintiff's interrogatories as follows, the numbers of the answers corresponding to the numbers of the interrogatories:

1. Yes.
2. Yes.
3. Yes.
4. Yes.
5. No.

5a. Concrete was dumped into the drum or vessel D through its top and the top closed. Then the valve in the compressed air supply was opened and the batch of concrete passing down the outlet E was ejected or shot into the conduit C to the forms by pneumatic pressure passing through the nozzle F.

[fol. 30] 10. Both defendants will rely upon all the prior art cited in the answer to establish that the patent in suit is anticipated.

11. Both defendants will rely upon all the prior art cited in the answer to establish that the patent in suit is lacking in invention.

John J. Kennedy.

Duly sworn to by John J. Kennedy. Jurat omitted in printing.

[fol. 31] IN UNITED STATES DISTRICT COURT

[Title omitted]

Case

Before Honorable Augustus N. Hand, District Judge

New York, October 4th, 1926—12 M.

Statement of Evidence

APPEARANCES OF COUNSEL

Stephen J. Cox, Solicitor and Counsel for Plaintiff.
John D. Morgan, Solicitor for Defendants, John D. Morgan and Alan M. Johnson, Counsel.

(Mr. Cox stated to the Court.)
(Mr. Morgan stated to the Court.)

[fol. 32] OFFERS IN EVIDENCE

Prima Facie Proofs

Mr. Cox: I will offer in evidence a stipulation providing for uncertified copies of the patent in suit, and other patents and also for the use of exhibits from the Ulen suit without certification, as papers in that suit.

(Marked Plaintiff's Exhibit No. 1.)

I will now offer in evidence a copy of the patent in suit.

(Marked Plaintiff's Exhibit No. 2.)
(Claims 2, 4, 5, 6, 8, 9, 12, 15, 17, 19, 21, 22, 24, 28, 31, 32, 34 and 35 relied on.)
(Counsel for the plaintiff read to the Court the interrogatories, together with the answers thereto.)
(Counsel cited the following to the Court: Page 902 of the Compressed Air Magazine, published in June, 1924. Engineering News, page 266.)

Recess.

ANTHONY G. FLECK, called as a witness on behalf of the plaintiff, being duly sworn, testified as follows:

Direct examination.

By Mr. Cox:

Q. 1. Mr. Fleck, you are one of the defendants in this case?

A. Yes, sir.

Q. 2. And you were subpœnaed to attend here today?

A. Yes, sir.

[fol. 33] Q. 3. Have you got that subpœna with you, or a copy of it?

A. Yes, I have a copy of it here, or, rather, the original.

Q. 4. Did you bring with you, as required in that subpœna, drawings or illustrations of the defendants' machine?

A. I submitted some drawings to Mr. Johnson previously, that is, blueprints. I believe he has those in his possession. This is one of them (indicating), and here is another (indicating).

Q. 5. In answering the interrogatories propounded to you in this case, you referred to the cut of the defendants' machine published in the Compressed Air Magazine, did you not?

A. I believe they were attached, were they not? Yes, sir.

Q. 6. This drawing which I exhibit to you is an enlargement of that cut at the bottom of page 901 of the Compressed Air Magazine, and figure 12 of the cuts in the Engineering News Record? (Handing documents to witness.)

A. Yes, sir, those are they.

Mr. Cox: I will offer this photo in evidence, so that we will have the large illustration.

(Enlarged photo of the cut referred to on page 901 of the Compressed Air Magazine was received as Plaintiff's Exhibit No. 3.)

Q. 7. Referring to this drawing which is marked Plaintiff's Exhibit 3, I would like you to state what the part marked D as shown in the drawing is.

A. What it is?

[fol. 34] Q. 8. Yes.

A. Just part of the equipment. It does not answer any particular purpose. It is just a closure. That is the best way to put it.

Q. 9. I mean the vessel marked D.

A. To distinguish that from the lower section?

Q. 10. Yes.

A. That is just a closure.

Q. 11. That is a vessel to hold the concrete, is it not?

A. Yes, sir.

Q. 12. To hold the concrete to be conveyed and placed?

A. Receptacles, yes, sir.

Q. 13. What is this part designated by the letter A?

A. That does not refer to a pipe, does it?

Q. 14. Yes, this part connected by a line to the letter A, what is that?

A. This circular section is just a casting. It is the general design of the make-up of the machine. That is simply a battery of air inlets in there.

Q. 15. This letter A refers to one of a battery of air inlets at the top of the machine?

A. That is a series of pipes going around there.

Q. 16. There is a pipe running from that air inlet away to the right. What is that pipe?

A. That is a pipe for the admission of air at times.

Q. 17. At the top of the vessel?

A. Yes, that is a feed pipe for that battery.

Q. 18. You are referring to the pipe which I now mark A^1, is that correct?

A. Yes.

Q. 19. Below the reference letter D there is a reference letter B. As I understand it, that is the lower tapering part of the vessel for holding the concrete?

A. Yes, sir.

Q. 20. Then at the bottom of the vessel there is an outlet marked E, is there not?

A. Yes, sir.

Q. 21. Then, leading away from that is a pipe or conduit [fol. 35] marked C?

A. That C refers to that joint, does it not? In back of that joint is a part of the bottom outlet.

Q. 22. The delivery pipe or conveying conduit extends away from that bottom outlet C?

A. Well, that C may refer to the piping you have got there. This is one fitting from here to here (indicating). C can be the discharging pipe, if you want to put it that way. It can be the orifice there.

Q. 23. C and E are all one fitting in the construction?

A. Yes, it is one casting.

Q. 24. Then the conduit or conveying pipe is this part in the photograph, the enlargement, which I am now marking J, is that correct?

A. That is part of the delivery pipe.

Q. 25. From C to J there is an upward bend in that pipe?

A. There is in that particular job, yes, sir.

Q. 26. Now, in the machine as actually used in the Queensboro subway tunnel by the defendants, did this delivery pipe J extend upwardly to a point above the machine?

A. Well, it all depends. If they were shooting at the bottom of the tunnel that would run out on the same level. If they were putting in an arch on a higher elevation, and I understand they went up fifty or sixty feet, it would naturally rise. It all depended on the location of the deposit. I believe in some cases they even shot below the machine. Of course, I was not there. You leave that pipe wherever you want it.

Q. 27. When the concrete was placed in the upper part of the forms of the tunnel, this pipe J ran up above the [fol. 36] machine, and then along horizontally?

A. Yes, it depends on the location.

Q. 28. Here at the top of this machine there is what appears to be a feeding hopper. Is that what was taken. That is a chute leading from the regular concrete mixer into that pneumatic placing machine. I guess it is a bag around there, or something.

Q. 29. You are referring to the part which I am now marking H?

A. Yes, that may have been a chute. It might be a piece of pipe. It looks like a rectangular chute from here.

Q. 30. What is this bulbous looking portion here, below H?

A. That is just a flared section. You see, the opening in the machine is about twelve inches, and this may be about two feet. It is just a lead to it, you might say.

Q. 31. And the concrete coming down the chute H was received in that part which you are now referring to?

A. Yes.

Q. 32. I will mark that G. That is the part referred to, is it not?

A. Yes, sir.

Q. 33. This part marked F at the bottom of the figure is a compressed air jet entering the outlet of the machine, is it not?

A. Blows right straight through there, yes, sir.

Q. 34. I notice that the man on the right has his right hand on what appears to be a valve handle. Is that a valve for admitting compressed air to the jet F?

A. Yes, that is the lower valve.

Q. 35. For admitting air to the jet F?

A. Yes, sir.

Q. 36. That is the part that I will now mark K. Is that right?

A. Yes, sir.

[fol. 37] Q. 37. Can you see that he has his left hand on a valve handle above K?

A. That is very indistinct. It is hard to tell. You very often lean your hand up there. You get tired running all day, and it is a good place to lean on.

Q. 38. At any rate, this part that I will now mark L, that is a valve controlling the air to the air inlet A, is that correct?

A. No, sir, that is not a valve you are referring to. It is a relief valve, that is what I call it, the one you just marked. That is only used when a machine gets plugged up, and you want to get the air off of it. That is a relief valve.

Q. 39. What is this part that I mark M here? Is that a valve controlling the compressed air to the inlet A?

A. That valve if operated would allow air to go into the upper section, yes, sir.

Q. 40. Can you tell whether the operator has his hand on that valve M in the picture?

Mr. Morgan: I object, your Honor. The picture shows for itself. The photograph is the best evidence

A. I could not tell where his arm is on that. He may be just having his hand resting on the pipe. I could not distinguish that. It is very obscure.

Q. 41. At any rate, that is a valve, that M which when operated admits compressed air to the top of the vessel D?

A. Yes, sir.

Q. 42. Now, between the receiver G and the vessel D, there is a door, is there not?

A. Yes, sir.

Q. 43. And how is that door closed?

[fol. 38] A. The door is closed by a finger or lever which is operated by a compressed air cylinder.

Q. 44. Is this pipe which I now mark N the compressed air pipe whch operates the door-closing cylinder?

A. Yes, sir.

Q. 45. And there is a valve on that pipe also; is't there?

A. Yes, sir. He may have his hand on that valve.

Q. 46. The valve controlling the door closing cylinder is between M and K, is it not?

A. Yes, you can see right from here that it is above his wrist there.

Q. 47. In this picture there is something to the left of the operator on the right, a round object. That is a pressure gauge, is it not?

A. Yes, sir.

Q. 48. That is the part which I will mark O, is it not?

A. Yes, sir.

Q. 49. That gauge shows the pressure of air on the pipe leading to the top of the vessel, does it not?

A. That gauge there shows the pressure of the air that is being supplied by a condensor. It is on the air line. It is your initial pressure. It is immaterial where you use it. Any air that goes into that machine, the initial pressure is marked by that gauge at the left hand of the operator.

Q. 50. That gauge indicates the air pressure on the machine?

A. The air pressure available, yes. sir. Not on the machine, but available.

Q. 51. Now, to the right of this operator and up near the top of the machine is another round object. What is that?

A. That is another gauge.

Q. 52. That is the part which I am now marking P, is it not?

A. Yes, sir.

Q. 53. And on what pipe is that pressure gauge located?
[fol. 39] A. That gauge is attached in that upper casting there somewhere around that mark A.

Q. 54. Does that show the pressure of air in the top of the vessel?

A. At different stages. When the material is out in the pipe it shows the pressure in the pipe. It shows the resilient pressure that is in the pipe. Until the material is all out of that receptacle, it would show the pressure that is above the concrete. After that it shows the pressure that is behind the material, or that is passing through the pipe.

Q. 56. From the time the compressed air is turned on with concrete in the vessel until the vessel is empty, that gauge P shows the pressure at the top of the vessel?

A. Not necessarily the top of the vessel. Any part of the whole apparatus. If you are shooting that concrete, say, five or six hundred feet it is just a question of some seconds before the material is out at that point, and whatever pressure you have from that point back to the machine also registers. That is the total pressure that is in the equipment as a whole.

Q. 56. That gauge P, though, communicates with the top of the vessel?

A. Yes, sir.

Q. 57. And the gauge O communicates with L?

A. Yes, sir.

Q. 58. And the gauge also, I assume, communicates with the pipe leading to the bottom jet F?

A. It is in that course of air travel, yes, sir.

Q. 59. These blueprints that you have produced, marked P. N. 40, and the other without a date, but showing a vertical section, illustrate the construction of the machine about which I have been asking you, do they not?

A. Yes, sir.

[fol. 40] OFFERS IN EVIDENCE

Mr. Cox: I will offer them in evidence, the elevation as Plaintiff's Exhibit 4, and the assembly drawing as Plaintiff's Exhibit 5.

(Marked Plaintiff's Exhibits Nos. 4 and 5.)

Mr. Johnson: No cross examination.

Mr. Cox: I wish to offer in evidence in this record as a physical exhibit some of the papers in the last suit, so that this record will show the issues on which the suit was based.

Mr. Morgan: I suggest you give the whole record as it is. There is a stipulation, I understand, that either side may offer that record if they see fit. If you see fit at the present time to offer part of it as a physical exhibit under that stipulation, we have the right to do the same later on, and we will have a rather complicated set of exhibits here, all relating to one thing. I think if we put in that whole thing at one time, the other parts will do no harm,, and we will have no trouble about it. I suggest that the whole record be offered as it is.

The Court: You may offer what you like of it, or offer the whole.

Mr. Cox: I wish to offer in evidence the bill of complaint, the answer, opinion of Honorable Learned Hand, order amending bill, answer of defendant Shandaken Corporation, stipulation permitting amendment of bill, and answers, amendment to bill, amendment to answer of Ulen [fol. 41] Corporation, amendment to answer of Shandaken Corporation, order amending answer of Ulen Corporation, order amending answer of Shandaken Corporation, and reply of Ulen Corporation to demand for particulars. They are, generally speaking the pleadings in the case on which the case was tried.

Mr. Morgan: Your Honor, we object to the offering in evidence of this portion of the printed record in the other case. We object to it first on the ground that it is irrelevant and immaterial, in every way. We suggest, however, that if opposing counsel want to offer the whole record, many parts of which are relevant, we will then withdraw our objection.

The Court: Objection sustained.

Mr. Cox: I wish to offer in evidence the two opinions, one by Honorable Learned Hand, and one by your Honor on final hearing.

Mr. Morgan: We make exactly the same objections that we did before on exactly the same grounds, and again make the same offer, that if the entire record is offered as a physical exhibit, we will withdraw our objection.

The Court: I will let him file copies of those opinions to aid the Court, if he wants to. I will sustain the objection to the offer, except that if he wants to put in the opinions, I will allow him to do it.

Mr. Cox: That is all I will offer at this time, then. I offer the opinion of Learned Hand as Exhibit 6, and the [fol. 42] opinion of your Honor as Exhibit 7.

(Considered marked Plaintiff's Exhibits Nos. 6 and 7 for reference of counsel.)

Mr. Cox: I would like to offer in evidence the decree in the Ulen suit.

Mr. Morgan: The same objection that was made and on the same ground, and the same tender as to the record in toto is made.

The Court: I will sustain your objection.

Mr. Cox: I have here witnesses who will testify briefly, if your Honor cares to receive such testimony, as to the success of the patented device. That was all put in in the other case.

The Court: Why do not you offer that? They have got a stipulation, have they not, that covered that?

Mr. Cox: Yes, the stipulation covers anything we may wish to offer.

The Court: I think you had better offer it. That has a bearing on the case.

Mr. Cox: I offer the deposition of Harry B. Kirkland, printed on pages 41 to 63 of the appeal record under the stipulation which admits evidence in the other case. Also the deposition of Arthur P. Robinson following it on pages 63 to 67, inclusive.

Mr. Morgan: The offer is objected to, first, on the ground that the depositions are irrelevant and immaterial in the present case, insofar as is shown by opposing counsel.

In the second place, we object to the transcript of record [fol. 43] in the preceding case being offered in this piecemeal manner, instead of in toto.

In the third place, we object to these depositions going in this case because it deprives us of the right of cross examination of the witness if they have testimony bearing on the issues in this case which are different from the issues in the other case.

The Court: I thought you stipulated that it might be offered.

Mr. Morgan: Not fractionally.

(The stipulation was then read by counsel.)

The Court: Objection overruled.

(Depositions marked Plaintiff's Exhibits Nos. 8 and 9.)

Mr. Morgan: I take an exception.

Mr. Cox: Your Honor, I have compared the defendant's structure in the opening with the claims of the patent in suit, and I have Mr. Ray here as our expert who can cover the question of infringement. I do not know how far you want to go.

The Court: I will not hear anything now, until they put in their case.

Mr. Cox: That will close our case, then.

Mr. Morgan: In connection with your ruling, I think Mr. Cox's rebuttal should be limited to answering our case.

The Court: That is true, but he could have rested practically with an offering of his patent, and proving simply your structure. That, I understand, is done. If you give [fol. 44] evidence which makes it necessary for him to call on an expert, he has a right to call him.

Prima facie proofs closed.

DEFENDANTS' PROOFS

Mr. Johnson: Defendants offer in evidence as Exhibit A the certified file wrapper and contents of the patent in suit.

(Marked Defendants' Exhibit A.)

Mr. Johnson: We offer in evidence as Exhibit B a book of the prior patents and also a photograph of the British Patent and a Knight's Mechanical Dictionary that was used in the other suit. I will now read the different patents so that there will be no mistake about them:

122,497, Smith, January 2nd, 1872;

122,498, Smith, January 2nd, 1872;

179,055, Prindle, June 20th, 1876;
276,318, Beech, November 14th, 1882;
408,201, Wallace, July 30th, 1889;
599,055, Davidson, February 15th, 1898;
609,744, Hennig, August 23rd, 1898;
671,303, Warren, April 2nd, 1901;
747,396, Farham, December 22nd, 1903;
758,118, Sticker, April 26th, 1904;
837,113, Phillips, November 27th, 1906;
873,345, Canniff, December 10, 1907;
958,421, McIlvrit, May 17th, 1910;
British patent to Trewent, No. 12,758, June 30th, 1894;

[fol. 45] Knight's Mechanical Dictionary, pages 775, 776, 1185, 1186 and 52.

(Marked Defendants' Exhibit B.)

Mr. Cox: I would like, in order to save time and to clear the matter up, to ask Defendants' counsel to admit that all of these patents except the two Smith patents were set up in the answer of defendants.

Mr. Johnson: No, that is not true.

Mr. Cox: Which of them were not?

Mr. Johnson: McIlvrid.

Mr. Cox: No, sir; that was in the answer.

Mr. Johnson: I do not think that is in the answer of the first suit.

I will now offer in evidence a certified copy of the McIlvrid patent as filed in the Patent Office, that is Patent No. 958,421. That has already been offered. This offer is made because under the practice, which I do not understand the reason for, but nevertheless it is the practice, that if you wish to rely upon the filing date you have to file a certified copy of the specification other than in the printed copy.

We also offer in evidence that portion of the transcript of the record in Concrete Mixing and Conveying Company, Plaintiff-Appellee, vs. Ulen Contracting Corporation and Shandaken Tunnel Corporation, which has not been offered in evidence by the other side, so that the entire record may be before the Court as an exhibit.

[fol. 46] WILLIAM ARTINGSTALL, called as a witness on behalf of the defendants, being duly sworn, testified as follows:

Direct examination.

By Mr. Johnson:

Q. 1. Mr. Artingstall, will you please give your name, age, residence and occupation?

A. Name, William Artingstall; fifty years old; residence, Chicago, Illinois.

Q. 2. And your occupation?

A. Occupation, civil consulting engineer.

Q. 3. What education and practical experience have you had with building construction?

The Court: Do you call him as an expert?

Mr. Johnson: I have to qualify him, your Honor, under the decision of the Court of Appeals of this Circuit to show your Honor that he is qualified by education and training to testify as to the prior use.

The Court: That is all right.

Mr. Cox: We will admit that the witness is able to understand.

Mr. Johnson: No, sir; we want his qualifications on the record.

Q. 4. The question is what education and practical experience have you had on building constructions?

A. My education was gained through various schools, the University of Cornell, and according to the old English practice of a father who happened to be an Englishman, a [fol. 47] good deal of tutoring. In fact, I was brought up from the time I was a small boy and tutored, I might say, in civil engineering. My father was probably one of the best civil engineers in the United States. He brought me in contact with engineering work as far back as I can remember as a very small boy, and I naturally followed it. I followed in his footsteps.

I was engaged at various times from the time of my university experience until the present time in civil engineering. In the early stages of my experience I was engaged as an employee in various capacities until about 1913 or

1915, in that neighborhood, when I entered the consulting practice and have been in that ever since, maintaining a private office for consultation work.

In the last five years I have not done so much consulting work for the very simple reason I am in a position where I take what I please and do what I please. I sandwich in considerable pleasure with my work. In other words, I select what work seems to interest me.

I am at the present time also consulting engineer for the Commissioner of Public Works in Chicago, being his personal representative. His work involves—this department work involves all the engineering work taken up by the City except what we call local improvement work, works paid for by local assessment.

That work with which I am directly interested or may be consulted on, is waterworks, sewers, pavements, street cleaning and garbage disposal or other works in which I may be particularly qualified.

[fol. 48] Also I represent the Commissioner as his personal representative on the big railroad terminals which he was designated in the ordinance governing that work as being the representative of the City. This work involves about,—one terminal which is practically completed, involves about $60,000,000; the other one under way is about $110,000,000 as near as we can estimate at the present time. The other terminal which we are about ready to start has been estimated at about $320,000,000.

That I think in general covers my experience.

Q. 5. About how many employees are there in the department under you as general consulting engineer?

A. The Department of Public Works employs about ten thousand employees; that includes all classes.

Q. 6. Can you give me any approximate idea of the cost of the construction jobs that you were on before you began consulting engineering work for the City of Chicago?

Mr. Cox: How does that have to do with the witness's qualifications?

Mr. Johnson: It is necessary under the practice in this Circuit for me to qualify him.

Mr. Cox: How many people are working on the City of Chicago Department of Public Works?

The Court: I will sustain your objection. It is too elaborate.

Mr. Johnson: Exception.

Q. 7. What practical experience have you had with concrete and concrete construction?

[fol. 49] A. I have designed a great number of concrete works, and supervised the carrying out of the works. Three pretty large tunnels under the Chicago River, I think they were about two million or two million and a half dollars, a rather large job; and the Chicago Municipal Pier involving about five million dollars, is another job, and various street railway works and water works of various kinds and various locations.

Q. 8. Have you had any practical experience with the pneumatic conveyor for concrete?

A. Yes.

Q. 9. Please state what your experience in this line has been?

A. My first experience with a pneumatic conveyor was about 1901. At the time I was employed as engineer for Healy & Ward, Watertown, New York. At that time we had a rather difficult job of cutting a head race in which the water from the Black River was seeping through into the excavation, which made it very expensive work to carry on. I suggested at that time the possibility of cementing or building up a concrete dyke between the different layers of shale, this was a shale rock, and of course you know how that comes, just like so many leaves in a book. We tried to build up a concrete dyke in there and shut the water off from the River. Of course, this machine at that time was a very crude affair, but answered our purpose, and that was all that was necessary.

Q. 10. Have you recently made a sketch of that first machine for placing concrete by air?

A. I have arranged this from recollection, this memorandum.

[fol. 50] Q. 11. Would you recognize an enlargement of that, if you saw it?

A. I would.

Q. 12. I call your attention to this sketch at the top here.

Mr. Morgan: Mark that for identification.

(Marked Defendants' Exhibit E for Identification.)

Q. 13. The first sketch on Exhibit E.

A. Yes, sir.

Q. 14. Will you please describe in your own way just exactly how that machine operated?

A. That, as I said, was a rather crude machine. We did not go to any particular expense in building this up. This is a piece of cast iron flanged pipe (marked 1), an ordinary flanged water main. This was a cap which we used in ordinary water works for blocking off the end of a pipe (marked iron plate 2 and iron plate 3). These were holes drilled in (marked 4, 5 and 6), the iron plates 2 and 3.

Mr. Morgan: I think you had better use reference letters.

(A short recess.)

Mr. Johnson: Will you read the question and answer?

(Q. 14 and anwser thereto read.)

A. (Continuing:) In the operation of this machine the hole marked 4 was for an inlet, air inlet. The hole marked 5 was a hole for the inlet of materials. The hole marked 6 [fol. 51] was the discharge outlet from the machine proper. In using this machine the materials were mixed up and dumped into this hopper that we call No. 7. The valve D in the base of the hopper 7 was the opening through which the material dropped into the machine or the section of cast iron pipe which acted as the machine. The valve A was then opened, followed almost immediately by the opening of valve B, the material occupying the space depending of course on how much there was to be put in, whether it would be half way up the pipe or whether it would be more or less.

I will call particular attention, your Honor, to the part there which we had to insert afterwards, and that is this little plug labeled 8. The reason necessitating that was that the material would pile up along from the discharge outlet to the side of the pipe itself gradually getting to a point

where it was almost impossible to put any more material in, and we then would take a rod and take this plug off and take a small rod and work it around inside there and loosen up this material and discharge that out. That, I think, in substance and in brief is the description.

Q. 15. You spoke of the material, Mr. Artingstall. What materials were they?

A. In this particular case we were using sand, cement and water.

Q. 16. What do you call that?

A. I have always called that grout.

Q. 17. Is that thick or thin?

A. It is pretty thin material.

Q. 18. About the consistency of what?

A. Well, roughly, let us say, the consistency of thick cream. It is very sloppy stuff.

[fol. 52] Q. 19. How large was the diameter of the opening 4 that connected with the pipe in which valve A was located, approximately?

A. This machine was made up from ordinary material which a contractor would have on hand, steam-fitting material, water pipe materials and so forth.

These were steam valves and pieces of steam pipe. Valve A was a steam valve and valve B was a larger steam valve. This valve B was what what we called a butterfly valve, this is, it opened up with a full opening with one half motion.

Q. 20. You speak of a steam valve. Did you use steam or what did you use?

A. We used air.

Q. 21. About what pressure?

A. On that we did not use very high pressure, propably about,—the pressure was not necessarily very high because we did not have very high pressure to work against.

Our proposition was to get the grout into or between the layers of rock, which was only a short distance below our surface, twelve feet; and it was only necessary for a very little pressure, in the neighborhood of 30 pounds.

Q. 22. How large was the diameter of the hole No. 6?

A. That was approximately a 4-inch pipe.

Q. 23. And what was the diameter of the pipe that I have marked No. 9?

A. That was also the same size. In fact, when we got out here to a point we throttled it down, because we had only an inch and a half pipe running into the shale rock. We had to throttle it down; there was no necessity of carrying a larger pipe.

Q. 24. What distance did you have the discharge from [fol. 53] the receptacle which you designated No. 1? How far did you shoot it?

A. That ran only a short distance, not over twenty-five feet I would say at the outside.

Q. 25. Now, will you describe a little more in full just exactly how you operated the valve with relation to the charge?

A. The charge was mixed up first and put into this hopper (7). The valve B was opened and the charge dumped in the cast iron pipe plug. This valve B then had to be closed and that left the charge in an enclosed receptacle with no air either on top of it or behind it. The valve A connecting with the receiver, the air receiver running directly from the compressor.

You understand, your Honor, that where the air compressor is small in capacity and you want to use a considerable amount of air, you use a receiver. It is nothing but a boiler to store your air up. That acts as a reservoir. That has say 1,000 cubic feet of air under a pressure of thirty-five, forty-five or fifty pounds, whatever you may use, whereas the capacity of your compressor might be only as high as 100 cubic feet. In other words, it acts as a reservoir.

This portion marked (1) air inlet led from the air receiver so that as soon as the valve A was opened, the air which was in the receiver was shot through the pipe and through the opening marked 4. The connection back from the receiver through the air inlet from the compressor, we will mark that No. 10. The valve B in the pipe 10 was opened as soon as possible after valve A was opened.

[fol. 54] Q. 26. Do I understand then that you first put pressure above the mix in the receptacle and then later opened the valve B through the length of the pipe No. 9, to where you desired to place it?

A. Oh, yes. You had to do that. If you did not do that why your air from the air inlet and opening marked 12 would just blow a hole in your discharge pipe.

Q. 27. What date did you use this pneumatic conveyer?

A. That was in 1900.

Q. 28. And where?

A. At a place which we called Black Rock near Watertown, New York.

Q. 29. Was it used successfully?

A. Yes, no question about it. It answered our purpose.

Q. 30. Now, as I understand it, you used only grout?

A. Yes, sir.

Q. 31. Is that right?

A. Yes, sir.

Q. 32. Now, does grout have gravel or stones in it?

A. It has small stones in it, yes.

Q. 33. About what size?

A. Well, with us—I have got to always refer to my own experience. We have a different sizes of sands. In some places the sand is very fine, in others very coarse. For instance here you get a river sand with not so many stones as you get in Chicago, in what we call torpedo sand. Torpedo sand was named because it had small stones in it like the toy torpedoes. Now, your stones will run from infinitesimal size—and we have got it pretty well settled wherever torpedo sand is used—it runs up to a half inch and a quarter of an inch. It is also called pea gravel, when the sand is screened out.

Q. 34. How do you fix the time as being 1900, is that it?

A. 1900.

[fol. 55] Q. 35. How do you fix that date?

A. That was the only date I was over in Watertown, and I fix it because of the fact that I had considerable difficulty getting life insurance on account of a physical condition. My policy was issued on January 9th, 1901, and I received it after I had left Watertown, and I have never been back there since.

Q. 36. You made the application before you left Watertown?

A. Oh, yes.

Q. 37. Of course, I mean the application for your insurance, and no other form of application?

A. Yes, my last examination was just a couple of days before Christmas.

Q. 38. Now, have you had any other experience with pneumatic placing of concrete or grout?

A. In this way, yes. After I left Watertown I was engaged by the Sanitary District of Chicago, and George W. Jackson was a very prominent contractor there. Jackson and I were pretty good friends, and he was, if I may be a little bit crude, he was a bug on new methods or new applications of old methods to anything which would help him on his concrete work.

I mentioned to Jackson the fact that I had used or developed this machine for placing grout. I might say, your Honor, that I have always been particularly interested in tunnel work, and Mr. Jackson was doing an enormous amount of tunnel work at that time.

I do not know whether you are familiar or not with tunnel work, but in placing concrete along the invert or bottoms and the sides of a tunnel it is a very easy matter to place the concrete, but when you get up into the arch, the [fol. 56] keying in, which may or may not be in the form of a key stone, anyhow it is the place where you have to put your concrete in the top of the arch, that is a different propos-tion, and it is very important that the concrete be placed in there as solidly as possible.

Jackson had tried, after he had been down in this Illinois tunnel which he had under construction for a long time, he had tried various ways of putting his concrete up in there with rammers, pushing the stuff back, and it at first being more or less ready to begin to come out, and it was always at the top where the concrete would not stay.

It struck me that this or some adaptation of this machine would be just the ideal for placing what we call the key concrete or the arch concrete. I spoke to Jackson about it, and he took me over afterwards, or asked me to come over, and I went, to what we always called his job, where he showed me a machine. I sketched this out some time ago like this. This figure No. 2 of Exhibit E——

Q. 39. The lower portion of the exhibit. Will you describe it and letter it as you go along?

A. This middle portion labelled A was an iron cylinder. The part labelled No. 15 was an iron plate. The part

labelled I was a piece of cast iron reducer. The part labelled D was an iron pipe.

By the Court:

Q. 40. Where is the part labelled I?

A. Down here, sir.

Q. 41. I thought you said it was a cast iron reducer?

A. That is what we call it, your Honor. Like this glass [fol. 57] (indicating). This is a certain size but we want to bring it to a smaller size here so that this casting can be placed.

By Mr. Johnson:

Q. 42. In other words, change the casting?

A. It is nothing but a funnel.

By the Court:

Q. 43. It is an inverted truncated cone?

A. Yes, as we would say, nothing but a funnel. The part labelled H was the outlet or discharge pipe. The part labelled G was the connection from the lower portion of the machine to the outlet pipe H. E was a valve in the pipe leading directly to pipe J. Pipe F led to pipe J. C is a valve in the pipe D, and B was the cover for inserting the material into the machine. Pipe J led to the compressed air receiver.

When I saw this machine operated the materials were in this case concrete materials, that is when I say concrete materials, I differentiate between concrete and grout, meaning that the coarse aggregate was larger than a quarter of an inch, that is it was stone running up to an inch and an inch and a half. The concrete materials were mixed on the floor and deposited through the opening of which B is the cover, and that placed the materials directly into the machine. The valve C was opened, followed immediately afterwards by the opening of the valve E, and concrete was discharged through this neck G, and through the discharge [fol. 58] pipe H and deposited in the making of a concrete floor and underpinning, a small portion of the brick wall which was in this building.

By Mr. Johnson:

Q. 44. If I understand your testimony correctly, you saw a machine, built like this figure 2 on Exhibit E, convey concrete pneumatically, is that right?

A. Yes, sir.

Q. 45. And where was that?

A. That was in what we called the Jackson Shop on Adams Street. The number was 177 East Adams Street at that time.

Q. 46. When was that?

A. That was in 1903.

Q. 47. How do you place the date as 1903?

A. Well, if you are going to ask me that, I am going to get personal. I was married in 1904 and this shop happened to be on the way where I could walk home and also meet my prospective wife.

Now, when I walked in there and walked along—I do not think I said this before—this discharge pipe was not a straight pipe. It came out and for a ways went up over some other machinery and came down dropping and had a bag around it with a kind of curtain, and the material was dropped down into a box.

Now, as I said this was personal. I got too close to it and I was considerably splashed with concrete material, consequently I could not meet my lady friend that night.

Q. 48. Why was it necessary to drape a bag or baffle plate over the end of the discharge pipe?

A. If they did not do that the material came out with such force it just splashed over everything.

[fol. 59] By the Court:

Q. 49. Where was the bag?

A. May I picture it to your Honor? You know how an ordinary water tank for a locomotive comes down and you know they have a bag or a steel plate just like a bag right at the end to keep the water from splashing out of the receiver. This bag was right at the end of that pipe.

Q. 50. Where was it on this figure 2——

A. If I may carry this out a litte bit it was roughly like this (indicating) being a continuation of the tube.

By Mr. Johnson:

Q. 51. Was this bend higher than the receptacle or not?

A. Yes, it was.

Q. 52. Well then, break the line.

A. All right (witness does as requested).

The reason I said it was because the discharge pipe was hung along on the rafters, the ceiling rafters, while this was plenty low enough for a man to shovel the material from the ground up into this. The bag of which your Honor asked was hung at the point No. 16 on the continuation of the pipe labelled H.

Q. 53. Give the bag a number.

A. 17.

Q. 54. Are you through, Mr. Artingstall?

A. Unless there is something I have not made clear.

Q. 55. What air pressure did you use in this pneumatic concrete conveyer, Figure 2, Exhibit E?

A. That I could not state positively, as to what the pressure was there. Jackson was using air pressure for various [fol. 60] purposes, and he may have connected onto a 35-pound line or a 60-pound line. All I can say is that whatever pressure was used was sufficient to send the material out of the machine into the pipe H and splash considerable when it came out at the other end of the pipe.

Q. 56. When you saw this machine operating in 1903 was it being used for any particular purpose?

A. At the time he laid concrete floor in this building, No. 177.

Q. 57. What street?

A. Adams Street, East Adams Street.

Q. 58. Chicago, Illinois?

A. Chicago, Illinois.

Q. 59. Will you please state about what was the size of the opening that I have designated "18"?

A. That was as near as I can recollect about a 2-inch pipe, not any smaller. Two inches or two inches and a half.

Q. 60. And how large was the portion that I am marking "19"?

A. That was a four or six-inch. I am inclined to believe that it was a 6-ich, for this reason: at that time we put a couple of cement bags in the machine. Now, a cement bag

is a rather bulky proposition to force into a 4-inch pipe, which was rather a small pipe, and this would lead me to believe that I could without much question cross that 4-inch out and say it was a 6-inch.

Q. 61. What was the diameter of the discharge pipe?

A. That was a 6-inch pipe; that was a spiral riveted pipe.

Q. 62. What was the diameter of the air pipe F?

A. These were, both F and J were 2 or 2½ inches.

[fol. 61] Q. 63. In describing the operation of this pneumatic air blower, I think you omitted to state just exactly what you did with the cover B after the materials were placed in the vessel A.

A. That may look peculiar, Mr. Johnson. That cover B is on the top of the pipe while the air pressure is at the bottom. As a matter of fact, there were some stud bolts on here; that had to be bolted down after it was taken off. The cover B had to be bolted down after it was taken off.

Q. 64. Can you make stud bolts on that?

A. They are nothing but a bolt that comes in here (indicating). I call these stud bolts. I do not know whether they were stud bolts, may be they were a bolt that went through with another nut at that point. That was immaterial so far as this was concerned.

Mr. Morgan: Refer them up.

The Witness: That would be No. 20; bolts, No. 20.

Q. 65. Then as I understand your testimony after you put the sand, cement, water and gravel in the vessel A you clamped down the cover B before turning the air on, is that right?

A. Understand on this machine, Mr. Johnson, I was a spectator. Jackson asked me over to see how it worked, and his men did all the work.

So your question would be answered yes: His men as soon as they clamped down the cover B, turned the valve C, then the valve E almost instantaneously.

Q. 66. Did you see them use stone or gravel in this concrete that was blown from the vessel A in 1903?

[fol. 62] A. Jackson at that time was a great believer in gravel concrete. When I say gravel, I do not mean small gravel. I mean gravel, crushed gravel, that would run up to the same size or practically so as the crushed stone, and that would run to an inch or an inch and a half in diameter.

Q. 67. A moment ago you spoke of Mr. Jackson's men. Can you recall the name of any one of his men that were working or superintending that job at that time?

A. Mr. John T. Fanning was very intimately connected with it.

Q. 68. Is Mr. Fanning in the courtroom?

A. Yes, sir.

Q. 69. Is Mr. Jackson alive?

A. Mr. Jackson is dead.

Q. 70. How far did you blow the concrete from this pneumatic concrete conveyer?

A. That was about fifty feet.

Q. 71. About fifty feet?

A. About fifty, yes.

Q. 72. Could you have blown it any farther if it was necessary to do so?

Mr. Cox: I object to that as a matter of opinion. The witness has testified to certain facts, supposed to be facts.

Mr. Johnson: He is also qualified as an engineer, your Honor.

The Court: Overruled.

A. There is no question but what it could have been forced a great deal farther from the very fact that it came out from the end of the pipe with such force that they said to droop a baffle bag over it and let the material drop into a box at the bottom to keep it from splashing over. I do [fol. 63] not mean to say a box at the bottom; a box underneath the end of the bag 17.

Q. 73. I will ask you as an engineer if you had the proper pressure could you with this machine that you saw operate in 1903 blow concrete pneumatically several thousand feet?

A. Well, there is no question but that you can blow it, but whether it is economical or not is another question.

What I mean to say is this: The distance which material may be transported pneumatically depends on the capacity of your compressors, and on the unit pressure per square inch. Now, that is general. The only other factor is the friction in the discharge pipe itself. If all of those things are *pro*portioned correctly, there is no question at all but what you can discharge it as far as you want.

Q. 74. Did I understand that Jackson was using this identical machine in laying a floor and also underpinning, a commercial proposition?

A. Yes, sir, this was his own building.

Q. 75. His own building?

A. Yes, sir.

Mr. Morgan: Where was that?

The Witness: 177 East Adams Street.

Q. 76. You saw Mr. John T. Fanning, who is in the court room, operate that machine at that time, is that right?

A. Fanning did not operate it at that time. Fanning was there. A common laborer was doing the dirty work.

Q. 77. I mean Mr. Fanning was superintendent: was he or was he not?

A. Mr. Fanning was connected with George W. Jackson as an engineer at that time.

[fol. 64] Q. 78. And you saw him there while this machine was being used commercially to lay a concrete floor and underpinning in 1903?

A. I will not say that he was there at that particular time, for this reason, Mr. Johnson: Mr. Jackson and Fanning and I were pretty good friends for a great many years. We might have met on a certain day to go over to that same shop to see something entirely different. Jackson had various machines, so I cannot say that Fanning was with us at this particular time that I went over to see this particular machine.

Q. 79. But you know that Mr. Fanning was connected with the Jackson Company at the same time that this machine was used commercially in 1903?

A. Oh, yes.

Mr. Johnson: I offer Exhibit E for identification in evidence.

(Marked Defendants' Exhibit E.)

Q. 80. Are you a member of the Western Society of Engineers?

A. I am.

Q. 81. Do you know Mr. H. B. Kirkland who is present in the courtroom?

A. I do.

Q. 82. Were you ever present at a meeting of the Western Society of Engineers when he read a paper on the pneumatic method of concreting?

A. I was.

Q. 83. "Pneumatic Method of Concreting" stated to be covered by this patent in suit?

A. I was.

Q. 84. What is the practice of you engineers? After the article is read, do you discuss it or not?

A. Yes, generally the author who is to present a paper [fol. 65] if it has not been printed in advance, he often sends out typewritten copies—or he gives them to whomsoever he may think is qualified to discuss his paper and asks them to be present at the meeting—well, to be frank, so as his paper will not fall flat for the want of discussion.

Q. 85. Are those articles printed in the journal of the Western Society of Engineers?

A. A great many of them are.

Q. 86. Would you recognize this article that you heard Mr. Kirkland read if you saw it?

A. I would.

Q. 87. I call your attention to the journal of the Western Society of Engineers for May, 1918, Volume XXIII, No. 5, an article entitled "Pneumatic Method of Concreting" by H. B. Kirkland, M. W. S. E., presented May 13th, 1918, and appearing on pages 319 to 355 of that journal (handing paper to witness).

A. Yes, sir.

Q. 88. You just said you were present there?

A. Yes, I was present.

Q. 89. I notice in the discussion of that article some remarks by Mr. William Artingstall, is that yourself?

A. That is myself, yes.

Q. 90. I call your attention more particularly to your remarks appearing in that article, or in the discussion of that article, printed on page 353 of that journal of the Western Society of Engineers, and ask that you kindly read into the record the portion that I have marked?

A. Do you mean for me to read my discussion on that date?

Q. 91. Just that which is marked. I do not want the whole thing.

A. This is a discussion by myself on the paper which [fol. 66] Mr. Johnson spoke of. It reads as follows: "The development——

Mr. Morgan: I suggest that you read it as it appears so that it will be clear for the record.

The Witness: "Mr Wm. Artingstall: The development of the pneumatic mixer is interesting. About fifteen years ago this device was used in connection with an ordinary mixer as a transporting agent. The concrete was dumped into the hopper and transported by air pressure. The contractor, however, put something over on the engineers. He ran a batch or two through the hopper without putting it through the mixer, and discovered that he had a pretty good mix. From that time on it was dropped until about 1907 or 1908, when the Drake Machine Company, here in Chicago, took it up and started to improve it. We tried it out in the LaSalle Street Tunnel. I think that was the first time it was used after 1903. We made some tests on the concrete, and, as I recollect it now, the ordinary concrete running in a six to twelve-inch tube, withstood a pressure of about 1,900 pounds. We used pressures of about 2,300 to 2,700 pounds on some forty or fifty different tests. We used this system on account of the convenience more than anything else, but we found we had the best concrete, and we used it practically everywhere we could after that. I think you will find that if the mixers of the present time [fol. 67] compare with the ones used at that time, the work will compare favorably with the ordinary mixed concrete work."

Q. 92. Now, when did you make that comment, at the discussion of this article by the chief engineer of the plaintiff company?

A. That discussion was made——

Mr. Cox: I, of course, object to any statements in that article which are not within the personal knowledge of the

witness, and if so made, as hearsay, such as what the contractor did.

I understand that this article and his statements are simply being introduced to show that this witness made such a statement at that time, and not as evidence of the facts stated therein.

Mr. Johnson: Oh, yes.

Mr. Cox: All right.

Q. 93. Now, if you will tell the date, the date please, Mr. Artingstall, when you made that statement in this connection.

A. This was my oral discussion of Mr. Kirkland's paper, "The Pneumatic Method of Concreting," the same evening at which it was presented, May 13th, 1918. It was presented at the Western Society of Engineers.

Q. 94. Now, fifteen years prior to May 13th, 1918, would be what?

A. 1903.

Q. 95. Now, all through this article and also through this discussion that I have just mentioned Mr. Kirkland [fol. 68] and yourself differentiated between the mixer and the pneumatic transporting agent. Why was that? Why should you differentiate between the mixer and the transporting agent?

A. Well, there are a dozen different kinds of mixers. You can mix concrete with an ordinary shovel, but it is a very difficult proposition to transport it 50 feet or 100 feet or 1,000 feet on the shovel.

In other words, the proposition with one is getting it in the place where you want it to remain, whether that be in a tunnel, or a retaining wall or a seawall, wherever it may be.

Q. 96. What did you mean by differentiating between the two, that is, between the mixer and the pneumatic transporting agent?

A. Yes, that was just what I pointed out to you in answer to those two questions there, what we want is to get the material into a certain place, and there was only one way to get it there and that was to force it in.

Q. 97. By what?

A. The best way to force it in was by air.

Q. 98. In this article——

A. I might say, if I may expound a little bit. You wonder why I say air instead of steam, because steam will cause the setting of the concrete almost instantaneously. In some cases we have had concrete put in carriages with steam turned on it, and it would set within a very few moments, so that we finally had to dump the stuff out before we got it to the place. That was the reason we use air.

Q. 99. In this article when you stated, "About fifteen years ago this device was used in connection with an ordi- [fol. 69] nary mixer as a transporting agent, what did you have in mind at that time?

A. The mixers spoken of here or the machine spoken of here was used as a transporting agent not primarily as a mixer. That is, as I said, in the Jackson machine, the material was mixed on the floor, by ordinary labor and thrown up with shovels into the hopper and transported by being carried through this pipe and over or across other machines which happened to be in the shop to the place where they wanted to put it.

Q. 100. In your last answer and one or two of the others you have referred to these machines on exhibit E. Why do you refer to this machine here, figure 2 of exhibit E, as a transporting agent?

A. Well, because that is what it was used for.

Q. 101. Was that the one you had in mind that was stated "about fifteen years ago"?

A. Yes, sir.

Mr. Johnson: The Journal of the Western Society of Engineers, May, 1918, Volume 23, No. 5, copyrighted in 1918 by the Western Society of Engineers, is offered in evidence as Defendant's Exhibit F.

Mr. Cox: The whole journal?

Mr. Johnson: Well, no, just a portion of it if you wish me to designate it.

Mr. Cox: What portion of it are you referring to?

Mr. Johnson: That is, I am offering the article and the front cover, covering the article entitled, "The Pneumatic Method of Concreting," by Mr. H. W. Kirkland, M. W.

[fol. 70] S. E., presented May 13, 1918, and the discussion thereof running from page 319 through page 355.

Mr. Cox: I object to anything except the statement of the witness here. I do not know the rest of it. As I understand it, this witness has been simply asked to prove that he made a certain statement. Now, if the rest of the article is to be put in evidence it ought to be proven and its relevancy shown.

Mr. Johnson: I have proven the fact that the paper was read at this meeting by this witness. He was there and he discussed it.

I can undertake to show the relevancy of it in the arguments. It is a matter of argument, but I will argue it now if your Honor so desires. It contradicts everything they have.

Mr. Cox: It is not relevant if it is being offered as a statement made by Mr. Kirkland. He is here and can be asked about it.

Mr. Johnson: This man was present during the reading of that article, he heard it delivered and discussed it.

The Court: What are you trying to prove by it?

Mr. Johnson: I am first trying to prove that this statement was not simply an afterthought by Mr. Artingstall, and that there is documentary evidence that in 1918 Mr. Artingstall said that this pneumatic method of conveying concrete was old fifteen years before that.

That is the first thing. That shows that in this discus-[fol. 71] sion of this article he stated it was old in 1903. He established that. The whole article is necessary to show just exactly what Artingstall was talking about.

The article is on mixers and is given by the chief engineer and vice president of the plaintiff company, and, as a matter of fact, it deals all the way through with their structure which contradicts their present contention.

The Court: I think I will allow it.

Mr. Cox: May I say here this is supposed to be a statement made by Mr. Kirkland, and Mr. Kirkland is present and if they want to prove that statement they ought to call him as a witness.

The Court: I think that is true.

Mr. Johnson: I will offer it as prima facie proof and if they want to deny it they can call him.

Mr. Cox: I will object to it.

The Court: I do not see how you can offer this strictly except to refresh his recollection in order to show some date or something.

Mr. Johnson: Well, it does show the date, sir. It was printed and the paper was given in May 13th, 1918, and it was printed in May, 1918.

The Court: Do you wish to confirm what Mr. Kirkland is going to testify to?

Mr. Johnson: It contradicts what he is going to testify to.

Mr. Cox: Mr. Kirkland has not been called as a witness yet.

[fol. 72] Mr. Johnson: We have an opportunity to do so.

The Court: I will sustain the objection.

Mr. Johnson: Exception.

I would like, if I may, your Honor——

Mr. Cox: I do not object to what Mr. Artingstall said, if you want to put in that statement, I have no objection at all.

Mr. Johnson: He made that statement. Is it your position, your Honor, that I should call Mr. Kirkland for the purpose of proving this article? That copy is certified by that society.

The Court: This article states a lot of facts, as I understand it. Why should this witness be called to prove this article?

Mr. Johnson: Well, he heard it.

The Court: Why do not you call the man that wrote it?

Mr. Johnson: I do not know that I will have an opportunity.

Mr. Cox: He is here.

Mr. Johnson: But I need it very much. It is very material to our defense, and if they will produce him and keep him here I am perfectly willing to call him for its introduction.

Mr. Cox: We will keep him here.

The Court: They say they will keep him here.

Mr. Johnson: All right.

Q. 102. Did you ever know John McMichael, the patentee of the patent in suit?

A. Yes, I did.

[fol. 73] Q. 103. In what years?

A. I met McMichael and knew him best about 1910 or 1911.

Q. 104. Did he ever consult with you as to any pneumatic conveying mechanisms in 1911?

A. We were constructing the La Salle Street tunnel. McMichael wanted to introduce his conveying apparatus to the contractors at that time. I was engineer of design and in charge of the work for the street railway company, and both supervisor and engineer.

The machine was made in the Drake Machine Company plant, and there was considerable trouble in getting the thing onto the job and getting it started and one thing or another. My interest was to get the work through, so I gave all the help I could to both the contractors and to McMichael, whoever asked me to go over there first, I do not know, but I went over there and gave them whatever help and information I could to get the machine onto the job.

Q. 105. Do you know about when McMichael built his first concrete mixer?

A. Well, I do not know when he built the first one. The first one that I ever saw was in 1911. This one I was just speaking of, having been used on the La Salle Street tunnel.

Q. 106. Have you got a photograph of that?

A. I have it in that pamphlet there, Mr. Johnson.

Q. 107. (Handing paper to witness.)

A. Yes, that is it.

Q. 108. You have a photograph? A. Yes, I have a photograph.

Q. 109. When was this photograph taken, about?

A. This was taken in 1911, along in the fall.

Q. 110. I notice that in this photograph is a picture of a [fol. 74] man, do you know who he is?

A. He was one of my inspectors, by the name of Coombs.

The Court: Are you going to mark that?

Mr. Johnson: Yes, sir, Exhibit G. I offer this in evidence.

Mr. Cox: May I ask for what purpose this is offered? This photograph was taken some four years or more after the filing of the application for the patent in suit, and it does not seem to me to be relevant.

Mr. Johnson: It shows the construction different from that illustrated in the patent in this form, and the questions I now ask show the relevancy.

The Court: All right.

(Marked Defendants' Exhibit F.)

Q. 111. Did you see this machine operate?

A. Oh, yes, many times.

Q. 112. Will you briefly describe how it did operate?

A. The operation, at the upper part is a hopper which I am going to call H, which is practically at street level. There is a large valve immediately below that which I will call K. The machine itself was composed of three different sections, which I am going to call M, that is, there is the center portion, an upper portion and the reducing portion.

At the lower portion of the machine (M) is the bend leading to the discharge pipe and in fact is a portion of the discharge pipe which I am going to call P. Off to the right in the upper section above the flange is a small pipe [fol. 75] with a valve on it, and the pipe and the valve I am going to call No. 1, which is a litle bit farther to the right of that which is a Y connected with a pipe leading down toward the foot of the machine connecting it to another Y, and this returning through a pipe to the air line. I will call the whole business No. 3.

Now, the materials were put in at street level into the hopper up in here, and the valve——

By the Court:

Q. 113. Where is that? This is the hopper?

A. The materials were put into this hopper, then valve K was opened, the materials dropped into the machine M, and the valve L, leading into the top of the machine and the other one leading down into the discharge pipe, were opened, almost simultaneously as near as could be done; the material was then discharged through the pipe P down under the pipe on which the young man is sitting, down into the tunnel and to the place where the material was to be dumped.

By Mr. Johnson:

Q. 114. What was the consistency of the concrete that was blown out of that machine as shown by the photograph, Exhibit F?

A. That was a pretty wet mixture, pretty wet. It was all concrete mixture. My specifications on all this tunnel work ran on the river section, 1, 2 and 4; that is, one part cement, two parts of sand and four parts of stone, not to exceed one [fol. 76] or one and a half inches in diameter.

Q. 115. Did you make any suggestions in the building of this commercial machine?

A. We had a lot of trouble. There was considerable trouble on this, and the material instead of, when they opened that valve K—let me put it this way: before the elbow of the pipe P was made of cast iron, they used a spiral rivetted pipe. Now, when the material came down through the valve K and the air pipe No. 1 leading into the top of the mixer it was turned up, there was considerable clogging of material in this lower portion of the elbow P; and I suggested to McMichael that he could get rid of that by putting a connection down here at the lower end of his pipe by inserting a connection down near the elbow. That is shown in here. That is the connection coming down through here (indicating), No. 2.

Mr. Cox: McMichael is dead and his application for a patent was on file more than four years prior to this and speaks for itself. At least it is incompetent, irrelevant and immaterial.

The Court: Overruled.

Q. 116. Do I understand, then, Mr. Artingstall, that McMichael attempted to build a machine like the drawings of his patent with air coming down and the air pipes (2) coming down as shown in the figure of his drawing, but that that was not satisfactory?

Mr. Cox: I object to this. This witness says that he does not know when McMichael built his first machine, and naturally he does not know how many machines McMichael [fol. 77] built. It is highly irrelevant to the issues in this case.

Mr. Johnson: This witness is testifying to his personal knowledge. This machine right here in 1911 was clogged up and was unsatisfactory.

Mr. Cox: It is entirely irrelevant and immaterial. It would not have made any appreciable difference if he changed his patent construction.

Mr. Johnson: His patent application is inoperative as filed.

Mr. Cox: That is another question. This thing here varies from the patent in various particulars.

The Court: Overruled.

Q. 117. Go ahead.

A. Read the question and answer, please.

(Question and answer read.)

A. The trouble we found with that pipe 2 coming in there was that the air blew a hole through the material.

Q. 118. That is through the concrete?

A. Through the concrete material. In other words, the air exhausted through pipe 2 and out through his discharge pipe 23 lifted the material up above your arch over bend.

Q. 119. You made a suggestion then. What was your suggestion?

A. My suggestion was he put the connection down at the lower portion of his bend as shown in this photograph, marked as No. 2.

Q. 120. And that was in 1911?

A. 1911, yes, sir.

(Adjourned to Tuesday, October 5th, 1926, at 10:45 o'clock A. M.)

[fol. 78] WILLIAM ARTINGSTALL resumed:

Direct examination.

By Mr. Johnson (continued):

Q. 120. Mr. Artingstall, yesterday in your testimony you referred to seeing this concrete blower, figure No. 2 on Defendants' Exhibit No. E, at 177 Adam Street; was that correct?

A. No, it is Monroe Street. It should be Monroe Street. If I said "Adam", I am mistaken.

Q. 121. Throughout your testimony, you mean Monroe Street?

A. I meant Monroe Street, yes, sir.

Q. 122. In referring to this concrete blower that you saw operated on that job for laying a floor and also for underpinning on Monroe Street in 1903——

A. Yes, sir.

Q. 123. Your testimony stated that the force of the concrete coming out through this exit pipe was so great that it splashed, and you had to have a baffle bag; is that correct?

A. Yes, sir.

Q. 124. About what was the consistency of the concrete that you saw coming out of this exit pipe H?

A. It was very wet, quite wet. I would say that you could compare it—if a man had stood on it, he would probably sink half way up to his knees.

Q. 125. Elsewhere in your affidavit you referred to the consistency of cream. Was it about like that?

A. Yes, just about the same, but, of course, having the stone in, a layman would probably say it was slush.

Q. 126. That is, very wet concrete?

A. Very wet, yes.

[fol. 79] Q. 127. In examining the operation of this machine, Exhibit No. 2, in 1903, did any slugs of concrete come out through the exit pipe H, or sections of concrete or segments of concrete, or how did they come out?

A. No, that concrete is carried along as a floating mass, and it just comes out in the one mass. In other words, the floatation mixture is carried. There are no slugs.

Q. 128. There are no slugs of concrete or sections of concrete segments of concrete; is that right?

A. No, I never saw any.

Q. 129. You mentioned a minute ago about coming out by flotation. What did you mean by that?

A. When the air is turned into the concrete mixer, that is not only forced through and into the mixture, but carries the concrete mixture along with it. That is, it could be called an emulsification. The air is surrounding the individual portions of the concrete or certain parts of it, to lay around the stones. In other words, there is a continual

mixing through there, mixing with the air as well as with itself.

Q. 130. Is the air carrying it?

A. There is no question about that.

Q. 131. The air is floating it?

A. The air is floating it right along. If that was not so, if the concrete was carried along as a slug, there is no question at all but what the friction on the outside of the pipe, on each one of those slugs, would so retard it that the middle would be pushed ahead.

In other words, it would be broken up. The middle would then become the outside, and there would be a kind of whirling in and out motion, so there could not possibly be any [fol. 80] such thing as a slug.

Q. 132. Is that also true of a segment of concrete or a section of concrete?

A. I do not get that.

Q. 133. You just mentioned that slugs of concrete could not come out through this pipe H. I am asking you now if that action of yours applies also to sections of concrete, cylinders of concrete or segments of concrete, like a piston going through there, a piston of concrete.

A. I can not see that there is any possibility of shoving the piston of concrete through there, through the pipe.

Q. 134. I call your attention to Defendants' Exhibit F, which is a photograph of the McMichael blower, and ask you did you see that in operation?

A. I did, yes.

Q. 135. When?

A. In 1911.

Q. 136. With what sort of concrete was it employed, wet or dry?

A. It was a wet concrete.

Q. 137. Were there any slugs of concrete that came out of the exit pipe there?

A. Not that I ever saw.

Q. 138. How did it come out?

A. It just came out—possibly, I can picture it this way: If you can imagine a water faucet; giving it a quick turn, your water is coming slushing out of the faucet. You turn it off. That ends it except for the little bit that comes along

through the faucet itself. That is as near as I can picture it for a layman.

Q. 139. In this Journal of the Western Society of Engineers, page 353, marked for Identification as Defendants' [fol. 81] Exhibit F, I note that in your remarks you referred to certain pressures of 1,900 pounds and 2,300 pounds and 2,700 pounds. Did that have any relation to the air pressure in the pipe?

A. No, that has nothing to do with the air pressure at all. That merely referred to tests which we made on the concrete.

Q. 140. How do you make those tests?

A. On that particular job of which I was speaking there, we were continuously making what we call a full-sized tests; that is, blocks of concrete six inches or twelve inches cube, and we would take these cubes or forms, which are nothing but a box twelve inches each way, put that directly under the mixing and take the concrete right from the spout, so that we would get an absolutely exact mixture, the same kind and consistency that was going into the concrete. Then that was carried off to one side as close as possible to where that particular concrete was being used that day, so that the conditions of the test would simulate as nearly as possible actual conditions in the work. That is all those 1,800 and 2,200 pounds have reference to.

Q. 141. In your testimony yesterday, you referred to the relative costs of placing concrete by a pneumatic blower such as figure No. 2, Exhibit 3, and also Exhibit No. F. With relation to placing it by hand, what have you to say about that?

A. Concrete can be placed in a great number of different ways. In my experience where we used this, the only job of mine in which I could talk knowing what I was talking about, was that of the South Street Tunnel, but we found [fol. 82] that the cost of the concrete, as transported by this air mixer, exceeded the cost of transportating it by buggy, which is nothing but an ordinary wheel barrow, you might say a half barrel shape, and the material dumped into that and wheeled into place. We used this because of the inaccessibility of getting the concrete into the upper part of the arch. Where we used buggies, we would have to load them, take them down into the tunnel a distance

of about thirty feet, carry them along on a runway 100 to 150 feet, dump the material and then shove it back. In this way, we got out of practically two handlings.

Q. 142. Would the cost of operation figure in which method was used?

A. Yes, with a contractor more so than with an engineer. As an engineer, I do not care particularly how much a contractor is going to spend on his work as long as he is going to have money enough to carry my job through. The contractor has got to look at it from the other side of the fence.

Q. 143. Do you know of any instance where the buggy or hand placing superseded the pneumatic placing of the McMichael Blower, as Exhibit F?

A. Yes; on that same job we had that machine installed, but we found it cheaper to place the concrete in the lower part of the arch by means of these buggies and then place it again from the regular mixers to this air mixer and transported the concrete for the upper section by means of this air conveyor.

Q. 144. Then the contractor would use whichever method was the cheaper; is that it?

A. Yes.

Q. 145. I call your attention to the McIlvrid Patent, [fol. 83] No. 958,421, and ask you to examine the drawings and the specifications of the patent, and ask you whether or not you ever used the concrete or grout blower shown in that patent (handing paper to witness)?

A. Yes, I have used that.

Q. 146. When did you use that?

A. That was used late in 1911.

Q. 147. Who manufactured the device?

A. The name plate on that was the Cockburn.

Q. 148. What materials did you use?

A. That was a cement and sand and water, we called it a grout, very thin. We had no stones in it.

Q. 149. Did you have any small gravel in it?

A. No. I might say this, in explaining our use of that. We used it for the stoppage of leaks. The tunnel is under the Chicago River, and there is 27 feet of water over the top of it. From the top or surface of the water from where we were stopping the leaks was about 50 feet, quite a good

deal of pressure, and the amount of water coming through the concrete, of course, would add to the increased cost of operation of this tunnel. We desired to prevent as much water coming in as possible, and had one inch or one and a half inches and in some cases two inch pipes put back into the concrete. We then forced grout through these various sized pipes. So you see we had to have it very, very thin. In some cases, we used only water and cement.

Q. 150. Your recollection is that you did or did not use any pebbles in that grout?

A. No, I do not think that we used any pebbles at all.

[fol. 84] By the Court:

Q. 151. Do I understand you to testify that you used this device that is described?

A. This Cockburn, yes, sir.

Q. 152. What year?

A. That was in 1911.

Mr. Johnson: That was before the patent in suit.

By Mr. Johnson:

Q. 153. From your practical experience in handling a machine built under this McIlvrid Patent, 958,421, and the fact that the patent says that small stone may be used to build sea-walls and foundations and so forth, what would be your opinion; would that be wet concrete or not?

Mr. Cox: I object to that. That is simply asking for an opinion and a conclusion.

Mr. Johnson: He used the machine, your Honor, and he is a very capable engineer right in this line of business. The patent says that small stones may be used to build sea-walls and foundations. You would not make that out of grout. When you strengthen that with small stones, you get concrete. This man filed his application before McMichael filed his in the Patent Office.

The Court: I will sustain the objection to the question in that form. If you want to ask him some scientific ques-
[fol. 85] tion, you may do so, but you are asking him to construe the language of the patent, as I understand you.

Q. 154. Could the machine from your experience as an engineer familiar with concrete construction, could the machine shown in this McIlvrid Patent be used to blow wet concrete?

A. Oh, yes.

Mr. Cox: I make the same objection to that.

The Court: Objection overruled.

Mr. Cox: Exception.

The Witness: If I may make a statement, I think it would probably clear up my answer as to the possibility of using gravel in that Cockburn mixer. When I asked for the proceeding of the Western Society of Engineers, I was under the impression that there was a certain photograph in there which was taken under my direction. At that time we had considerable leakage in the Van Buren Street Tunnel, which is also a street railway tunnel under the Chicago River and under the same conditions which I described a few moments ago. The Great Lakes Dredge & Dock Company who had that contract, did not use the Cockburn mixer, but we took the same kind of mixer as is shown on the upper section of that Exhibit E there, as I described yesterday, using a cast iron water main, flanged pipe, and in that case we had one very difficult place or condition where [fol. 86] the pumps came down the shaft and an enormous amount of water came down. We could not possibly fill that hole up with grout, so there we made a special effort and actually shifted torpedoes there and finally got roofing gravel to use in that, call it grout machine or anything you want, that first design there on the Exhibit E.

Q. 155. When was that?

A. That was late in 1907.

Q. 156. Did you ever read a paper before the Western Society of Engineers describing the operation by you of a machine built in accordance with the McIlvrid Patent, No. 958,221?

A. That is manufactured by the Cockburn Company?

Q. 157. Yes.

A. Yes, sir, I did.

Q. 158. Please refer to it.

A. That is in the Journal of the Western Society of Engineers, Volume 16, No. 9, November, 1911, page 917, which

covers a portion of the discussion of my paper entitled, "The Chicago River Tunnels."

Q. 159. What you just referred to is a portion of an article written by you entitled, "Chicago River Tunnels, Their History and Method of Reconstruction," appearing on pages 869 to 921, is it not?

A. Yes, sir.

Q. 160. When was that article printed and published?

A. That was published in Volume 16, No. 9, November, 1911.

Mr. Johnson: I offer in evidence the Journal of the [fol. 87] Western Society of Engineers of November, 1911, Volume 16, No. 9, copyrighted 1911 by the Western Society of Engineers, and more particularly page 917 of the certain article just referred to by the witness.

Mr. Cox: I object to this offer. This is an article said to have been written by this witness in 1911, nearly five years after the application for the patent in suit.

The Court: What do you want that for?

Mr. Johnson: It is documentary evidence and corroborative testimony that he used this device in 1911; and that this patent is not a paper patent; that is, that machines were actually built under it and used.

The Court: How long was the article written before this suit was brought?

Mr. Johnson: Fifteen years.

The Court: I will let you put it in. I doubt if it is competent evidence. If it had been contemporaneous, I think it would be pretty poor evidence.

Mr. Cox: It is put in to corroborate the statement of the witness that he did make such statements in 1911, is that it?

Mr. Johnson: To corroborate his testimony that he used this machine in 1911, years before the suit was brought.

The Court: The article may be one that I would like to look at.

(Marked Defendants' Exhibit G.)

[fol. 88] Cross-examination.

By Mr. Cox:

X Q. 161. Mr. Artingstall, where is your office in Chicago?

A. I have two offices, one in 7 South Dearborn Street, and one in the City Hall.

X Q. 162. Your office at 7 South Dearborn Street is a real estate office, is it not?

A. No, it is not.

X Q. 163. What is the name of the firm on the door?

A. It is a suite of offices. Roe & Whitman are the holders of the lease of the suite.

X Q. 164. "Roe & Whitman, Real Estate Dealers" appears in large type at the head of the door, does it not?

A. Yes.

X Q. 165. And then there are about a dozen names in small type under that?

A. I do not think there are a dozen. There are about four, I believe. There are several of them.

X Q. 166. And yours is one of those names?

A. Yes.

X Q. 167. About how often do you go to that office?

A. Sometimes I go there every day; sometimes I do not go there for a week.

X Q. 168. You go there to meet appointments and get your mail?

A. Mostly to get mail.

X Q. 169. Just what is your connection with the City Engineer's office in Chicago. Are you employed by the City of Chicago on a salary?

A. I have no connection whatsoever with the City Engineer.

X Q. 170. Are you employed by the City on a salary?

A. Yes.

X Q. 171. Do you mind telling us what that salary is?

Mr. Johnson: I object to that, your Honor.

[fol. 89] The Court: Objection sustained. I do not see what his salary can possibly have to do with it.

X Q. 172. You have a desk in a small office in the City Hall; is that right?

A. No, I have a large office.

X Q. 173. How big is it?

A. About twenty feet square, I should judge.

X Q. 174. And there are some other men in that office?

The Court: I do not see what difference it makes whether he has a large desk in a small office or a small desk in a large office.

Mr. Cox: This witness has been telling us about his very important connections in Chicago, and I think I ought to be allowed briefly to show what they really are.

The Court: All right.

X Q. 175. There are several other gentlemen in that office with you?

A. My direct employees and assistants.

X Q. 176. How many employees or assistants have you in that office?

A. I have only one who is a real office man. The others come and go. Whether I have one or a dozen, it does not make much difference. That is, what I mean to say, Mr. Cox, is this: My position, as I stated, is a peculiar one——

X Q. 177. I am not interested in this unless the Court is. I want to know how many employees or assistants you have there now?

A. How many I have?

[fol. 90] X Q. 178. Yes.

A. I have the authority to call on any man in the Department of Public Works.

X Q. 179. How many assistants have you now, or employees? I am not talking about those who are employed by the Department of Public Works. Have you any?

A. Yes, I have. I think I see what you mean. I want to get it clear, Mr. Cox. I have directly assigned certain assistants to certain work. In my central work, I assign an assistant, that is, directly. On the Union Station work, I assign an assistant directly, or on any other work I assign an assistant directly. At the present time I have those three, with the office man, four all told.

X Q. 180. They are employed by the City of Chicago, these men?

A. Yes; indirectly by the City of Chicago.

X Q. 181. Referring to this apparatus which you say you used on the Black Rock job in 1900, were there any drawings or sketches or photographs made of the machine at that time?

A. Nothing other than probably just a rough sketch.

X Q. 182. Did not somebody make that machine and charge for the materials and time that went into the making of it?

A. I presume that it was charged up, yes, but it is just like picking up this piece of pipe one place and the castings somewhere else or the valves somewhere else, maybe on the job. There was no direct order placed.

X Q. 183. Was not some entry made in somebody's books at that time in connection with the making of that machine?

A. That I do not know.

X Q. 184. At any rate, you have nothing today in the nature of a drawing or sketch or piece of the machine or [fol. 91] book or bill dating about that time, to show the date or what it was?

A. I am inclined to say no.

X Q. 185. Have you not looked for it?

A. No, I have not.

X Q. 186. Have you not made any inquiries for that sort of stuff?

A. No.

X Q. 187. Did not defendants' counsel ask you to look up such things?

A. No.

X Q. 188. Then you have nothing today, so far as you know, that originated prior to the present year in the nature of a book entry or sketch or drawing or part of a machine or any visible evidence to show what that machine was or where and when it was used?

A. I would be inclined to say no, Mr. Cox.

X Q. 189. Have you endeavored to find anyone who saw you use that machine or knew about the use of it?

A. No.

The Court: Which machine is this, the one he used in 1911?

Mr. Cox: In 1900, at Black Rock, the one represented by the sketch, Exhibit E.

Mr. Johnson: Fig. 1 of Exhibit E.

Mr. Cox: Yes.

X Q. 190. Can you give us the name of anyone living who knew about that machine at Black Rock in 1900?

A. I have never been back to Watertown since I left. That is 26 years ago. I do not know whether they are living or not.

X Q. 191. Can you give us the name of someone who knew of it at that time, someone living?

A. I do not know whether they are living or not. If you [fol. 92] leave that "living" off, I can give you the names of some that I knew who were living at that time.

X Q. 192. Give us the name of someone living or dead who knew of the use of that machine in 1900?

A. I had a foreman by the name of Grannis——

X Q. 193. How do you spell that?

A. G-r-a-n-n-i-s.

X Q. 194. What was his first name?

A. Fred was his first name.

X Q. 195. About how old was he at that time?

A. He was in the neighborhood of 50 or 52 or 53; somewhere in that neighborhood.

X Q. 196. So he would be pretty well along toward 80 if living.?

A. He would be along in the seventies, yes.

X Q. 197. Anyone else that you can think of?

A. There was one of the members of the firm, James Ward.

X Q. 198. How old was he at that time about?

A. He was about the same age; possibly a little older.

X Q. 199. So these two men, if living now, are somewhere over seventy and along toward eighty?

A. Yes, I would say in that neighborhood.

X Q. 200. Did they both see this machine?

A. Yes. The machine was made—I would like to explain that a little bit.

X Q. 201. No, I am only asking whether they ever saw the machine?

A. It was made for them, yes.

X Q. 202. Did they see the machine?

A. It was made for Haley Ward, and Grannis was the [fol. 93] superintendent for Haley Ward.

X Q. 203. Did they see this machine and see it operate?

A. I know Grannis did.

X Q. 204. You do not know whether Ward did?

A. No, I would only have to assume that.

X Q. 205. I believe you said that you first used this machine which I will call the Black Rock machine with a top compressed air inlet only; is that correct?

A. In there (indicating)?

X Q. 206. Yes, shown in Fig. 1 of Exhibit E?

A. I do not think I said that.

X Q. 207. Then you did say, I think, if you did not have the compressed air inlet at the bottom, the compressed air at the top would blow through and defeat the operation of the machine; is that correct?

A. Yes, I said that.

X Q. 208. Will you explain just why that is?

A. Why the air will blow through the mass?

X Q. 209. Yes.

A. Of course, whether it blows through or not, Mr. Cox, is going to depend on the thickness of your mass. If you have a wet—let me make an extreme example—if you have only a liquid into the chamber itself with the discharge end open, you are going to blow the air directly through that liquid. Your other extreme is to imagine a solid plate. Let us make it an absolute extreme and say it is a steel plate in there. Of course, the air can not penetrate through that. Now, between the liquid and the solid plate, you have a great variation between which the air either will blow through or will not blow through. There is some particular point in there which is just on the balance.

[fol. 94] X Q. 210. We will use ordinary grout, which is a very fluid substance in such a machine as that shown in Fig. 1 of Exhibit E. Will that blow through?

A. It is a flowing substance, if it is kept agitated—and I am going to say right here that the trouble with that machine identified by the No. 1 on Exhibit E was that the material did get over that pipe, did clog it.

By the Court:

— Q. 211. What pipe?

A. Over the opening E leading into the discharge pipe. I explained that yesterday, and that we put this plug S in, to put a rod down in there and plug that out. That machine had to be agitated.

By Mr. Cox:

X Q. 212. You had to stick a rod down in the tank and get the packed material away from the discharge opening?

A. Yes, if your grout is real well, your ingredients are going to separate comparatively quickly from the water——

X Q. 213. I am not asking that. I want to know what you actually did. You had put a rod in there for breaking up the material and getting it away from the discharge opening where it was packed?

A. Yes, and this in Exhibit 1 had to be violently agitated until we could get the air started through from the valve A through the machine to carry the grout along.

X Q. 214. In this McIlvrid patent that you have referred to, do you find any bottom air inlet or lower air inlet?

A. No.

[fol. 95] X Q. 215. In that machine shown in the patent, there is only a compressed air inlet in the top of the machine; is that correct?

A. That is all, yes.

X Q. 216. And there are paddle wheels inside the machine to agitate the material?

A. Yes.

X Q. 217. And is it your testimony that without those paddle wheels, the machine would not operate properly?

A. I would not say that it would not operate, but the introduction of the paddle wheels keeps the material agitated, and that is just exactly what you are trying to do when you force that air through. On this McIlvrid, the material is being agitated by paddle wheels and the material is carried down with it and forced through that discharge pipe.

X Q. 218. What I want to know is whether, if you can state, that McIlvrid machine could be operated without the rotating paddle wheels inside the vessel?

A. I sincerely doubt that it could if it was placed in the same position that it is there.

X Q. 219. You would have to make some change in the construction and arrangement in order to get it to work; is that it?

A. Not necessarily making a change. You would have to make some arrangement for agitating the material, either using the machine itself and rolling it to keep that going until you got rid of it.

X Q. 220. You are talking about using this McIlvrid machine with grout?

A. Yes.

X Q. 221. With ordinary grout—I do not think you have answered my question—and with a top outlet only such as [fol. 96] is shown in Exhibit E, Fig. 1, and in the McIlvrid patent, would the compressed air bore down through the material?

A. There is a qualification as to how thick your material would be.

X Q. 222. With ordinary grout?

A. I know, but you can pack water so that you can not float through it. I think I can explain your question. Let us say that the diameter of the cylinder in that machine was two feet. If you had six inches of material on the bottom without a paddle wheel, so there was no agitation whatsoever, in other words, the machine was at rest, and you turned fifty or sixty pounds of air in through the top valve and opened up your bottom valve, there is no question but what you would blow a hole through that six inches of grout.

X Q. 223. And you would not discharge the grout. You would blow a hole through it?

A. You would have to discharge some of it.

X Q. 224. You would not get a discharge of the batch of grout in the mixer?

A. Not lying on its side like that.

X Q. 225. How about in the position shown in your sketch here, Exhibit E, Fig. 1?

A. That is just exactly what I said; that it was not satisfactory, the fact that the material piled up from the opening 6 towards the sides of the cylinder. In other words, there was practically a cone of material which was blown out.

X Q. 226. You have described an apparatus which you say was used in Chicago in 1903. That was at 177 Monroe Street, you now say?

A. East Monroe Street, yes, sir.

X Q. 227. Do you remember who owned that building?

A. I do notk now who owned it.

[fol. 97] X Q. 228. Do you remember who occupied it?

A. George W. Jackson occupied it.

X Q. 229. The entire building?

A. He had the entire building; double building.

X Q. 230. Was not that building occupied by the Tunnel Company?

A. It may have been the Tunnel Company, but George W. Jackson was the controlling feature of the Tunnel Company.

X Q. 231. I do not want you to argue this matter. I want to get through. The Tunnel Company had its men and its equipment in that building, did it not?

A. So far as that goes, I can not say whether they were directly employed by the Tunnel Comany or by George W. Jackson.

X Q. 232. It was a building occupied by those engaged in the Tunnel Company's work?

A. Not necessarily; not all of it. They were practically 90 per cent of the time engaged on tunnel work.

X Q. 233. Do you know what Mr. Jackson's connection with the Tunnel Company was at that time?

A. Jackson was engineer for the Tunnel Company and he was at that time, I think, also general manager.

X Q. 234. So that his occupation was conducting the operations of the Tunnel Company?

A. The operations of the Tunnel Company was only construction.

X Q. 235. His chief occupation was conducting their operations; is that right?

A. Now, I would not say as to that because I would not be competent to say.

X Q. 236. You mean you do not know enough about what Mr. Jackson was doing, to say?

A. I mean to say this, that I do not know what a man is [fol. 98] doing in his private capacity except so far as I come in contact with him.

X Q. 237. Mr. Jackson was a prolific inventor, was he not?

Mr. Johnson: I object to that.

Mr. Cox: That is very material, I think.

The Court: Objection overruled.

A. That I do not know.

X Q. 238. You know that he had a large number of inventions, do you not, that he was working on from time to time?

A. No, I knew of only two.

X Q. 239. What were they?

A. One was a loading machine and the other was a steel sheeting machine.

X Q. 240. I understood you to say that you were a pretty close friend of Mr. Jackson's; is that correct?

A. I said I was a pretty good friend of Mr. Jackson's.

X Q. 241. And that you came in contact with him quite often?

A. Yes, I came in contact with him.

X Q. 242. And yet you did not know that Mr. Jackson was developing any inventions except these two that you mentioned?

A. Jackson was very secretive about a great deal of his work——

X Q. 243. Now, please answer the question.

Mr. Cox: I object to this witness entering into explanations instead of answering questions. If you will read the question and answer, you will see what it amounts to.

[fol. 99] (X Q. 242 read.)

Mr. Johnson: Your Honor, they are absolutely fair and responsive answers and the attorney should not browbeat the witness.

The Court: Go on with your questions.

Mr. Cox: I am trying to get through with this examination.

X Q. 244. Did you not know that Mr. Jackson was working on any other inventions that he did not have to be secretive about, that he obtained patents for?

Mr. Johnson: I object to that.

The Court: Objection overruled.

The Witness: Will you please read the question.

(X Q. 244 read.)

A. No, I would not say that I positively knew any other patents.

X Q. 245. You made an affidavit in this case in June, 1926, did you not?

A. Yes.

X Q. 246. And your present testimony is that in that machine used by Mr. Jackson in 1903, he used stone up to an inch and a half in diameter; is that correct? Or crushed gravel?

A. I think I corrected that to say crushed gravel which runs up to an inch or an inch and a half in diameter.

X Q. 247. In this affidavit that you made in June of this year, you said "On this 170 East Monroe Job in 1903, I saw them mix sand, cement, water and gravel up to one-half to three-quarters inch in a concrete mixer and then place the [fol. 100] mixed concrete in the tank A through the cover B"; referring to the drawing from which Exhibit E, Fig. 2, was made. You made that statement, did you not?

A. Yes.

X Q. 248. So that the size of that crushed gravel used by Mr. Jackson has increased in your mind since June from three quarters of an inch maximum to an inch and a half?

A. No, I did not say that.

X Q. 249. You now say that he used up to an inch and a half?

A. I said crushed gravel—probably I did not make it absolutely clear. Crushed gravel running from an inch to an inch and a half. Let me explain this way: There are different sizes. We classify from half an inch to an inch as one inch gravel because it would pass through a one inch ring. We classify as an inch and a half gravel from one inch to an inch and a half or anything that will pass through an inch and a half ring. So I am perfectly consistent, Mr. Cox. If I say we use three-quarters of an inch gravel, what I mean is probably the average was three-quarters of an inch. Maybe the minimum even ran below half an inch. It sometimes slips over the screens. The largest may have been larger than an inch because it may not have been absolutely an inch in all directions.

X Q. 250. Then your statement in this affidavit that Jackson used gravel up to one-half to three-quarters of an inch is not the statement that you wish to make now; is that correct?

A. I will say this——

X Q. 251. Why not answer it?

A. I am going to answer it absolutely to your liking. I will say that I have my sincere doubts on 10 per cent of the

[fol. 101] gravel coming into Chicago being an inch and a half, although classified as that. I doubt if 20 per cent would run over an inch in diameter. We as engineers can call for crushed gravel from an inch and an inch and a half and know very well that we are lucky to get an inch. In other words, here is our whole object in Chicago. The crushed stone people had a monopoly and we wanted to break the monopoly or at least allow competing material gravel to come in with us. We shut one eye when we look at the sizes. It is immaterial.

X Q. 252. Is that statement in your affidavit correct or not, that the gravel used by Jackson was up to one-half to three-quarters of an inch?

Mr. Johnson: The witness has answered that question, your Honor.

The Court: Objection overruled.

A. In other words, what you want is what is the absolute say as to my recollection regardless of that.

X Q. 253. I want to know whether that statement in your affidavit is correct or not?

A. Yes, I will say that it is correct.

X Q. 254. And then your statement that the gravel used by Jackson was up to an inch and a half in your testimony here is not correct, is that right?

A. I just qualified that a moment ago. I explained just exactly what I meant.

X Q. 255. And you do not care to make any further qualification. You are satisfied to leave it at that?

[fol. 102] A. Yes.

X Q. 256. You have said in your testimony here, I believe, that Mr. Jackson used on that machine an air pressure of 35 pounds or more, is that correct?

A. I think that that is very close to correct.

X Q. 257. Well now, in this affidavit made by you in June you said, "After the tank A was full of mixed concrete the cover B was closed and the valve G and the air pipe B was opened to admit air of between 80 and 100 pounds pressure above the charge of the mixed concrete in the tank." Did you not make that statement?

A. That is true, too.

X Q. 258. Now, the size of this delivery pipe, the pipe at the bottom shown in Figure 2 of Exhibit E, what was that?

A. The pipe H?

X Q. 259. The pipe H?

A. The pipe H was a six inch pipe.

X Q. 260. And I believe that you said that the pipe F was about a two inch pipe?

A. Two or two and one-half inch.

X Q. 261. In your affidavit made in this present year in June, the affidavit to which I refer, you say that the "upper air passing through the pipe D above the charge forces the mixed concrete down through the exit pipe G of four inches and the other air passing down through the pipe F impels or forces this concrete and forces it out through the pipe H which was four inches." You made that statement, did you not?

A. I thought I said four or six inches on that.

X Q. 262. You made that statement, and I will show you a copy of the affidavit. Yes or no, please.

[fol. 103] Mr. Johnson: Here is a copy of your sketch.

Mr. Cox: Why coach the witness while I am cross examining him? I have not interfered with counsel.

The Court: Do not be handing the witness things when he is cross examining him.

A. Frankly it says so here but I did not appreciate it until just now.

X Q. 263. By the way, Mr. Artingstall, what was the date of your marriage in 1904?

A. June 18th.

X Q. 264. June 18th?

A. Yes, sir.

X Q. 265. This work on which you said you saw Mr. Jackson use a machine of Figure 2 of Exhibit E was in connection with the putting in of a tunnel in that building, was it not?

A. No, it was a floor in the building itself.

X Q. 266. What floor was it?

A. The basement floor.

X Q. 267. And had not they connected that with a tunnel, with the tunnel system? Did not this underpinning and the laying of the floor, was that work that was required by the tunnel connection?

A. No, not the part that I saw them putting in. That had nothing to do with the tunnel connection. In fact, I would not say whether there was a tunnel connection in there or not.

X Q. 268. You do not remember whether the tunnel was connected there at that time or not?

A. It was what you might call a machinery room. There was a compressor and various other machines there, and I never went down through that entrance. If there was a [fol. 104] tunnel in there I never went down there.

X Q. 269. Do you know whether the building is connected with the tunnels in the street?

A. No, I have never had any occasion to check on that.

X Q. 270. Now, this work of laying the floor that you have described, was that different from any other floor laying job?

A. No different except that there was machinery around the different places, that was all.

X Q. 271. In laying a floor it is usual and customary even today just to take the concrete, mix it and flow it out on the floor, is it not, through a chute or by means of wheel barrows?

A. With an ordinary man, yes.

X Q. 272. With ordinary men that is what is done?

A. With an ordinary man.

X Q. 273. That is what is usually done, is it not?

A. Yes, I would say yes, an ordinary man. In 99 cases out of 100.

X Q. 274. And where you are putting underpinning under walls it is only necessary to run the concrete down through a chute or shovel it down, it is not?

A. No, the underpinning of the walls is a pretty ticklish proposition.

X Q. 275. Well, is it usual just to shovel or run the concrete down through a chute, is it not, to the place where it is packed?

A. Well, it might be to the layman, but there are lots of things besides that.

X Q. 276. This machine that you describe as having been used by Jackson in 1903 did not pack the concrete, did it?

A. No, it was only transporting it.

[fol. 105] X Q. 277. It was only transporting it. If it needed packing that had to be done afterwards?

A. The material was wet enough so that it would pack itself.

X Q. 278. At any rate the building at No. 177 East Monroe Street where you say this work was done by Jackson was a building principally occupied by the work of the tunnel company, was it not?

A. Well, I stated that I did not know whether they were tunnel employes or whether they were George W. Jackson employes. Jackson also ran the Jackson Bridge & Iron Company.

X Q. 279. That was not located at 177 Monroe Street, was it?

A. No, his shop was farther up the river, but whether the men were designing on that, I do not know.

X Q. 280. Do you remember about what the size of the vessel was that you have described as used by Jackson in 1903?

A. Do you mean the machine?

X Q. 281. Yes.

A. To the best of my recollection that was in the neighborhood of 20 or 24 inches in diameter. Let us see, if I just stand up I will get an idea as to the way it looked. The platform itself, we will say, is four feet off the ground; the incline section comes down about in the neighborhood of 15 inches below the platform, and the upper section was two feet or maybe 27 inches above the top of the platform itself. Is that sufficient?

X Q. 282. Yes.

The Court: Where was the machine with reference to [fol. 106] the concrete, or fluid, however you may describe it, that was deposited?

The Witness: It was deposited in different ways, your Honor.

The machinery was lined up along the wall. There were pipes of various kinds in there, and the only reason I could see for using this machine in that particular case was to prevent the slopping of the concrete when they would throw it in shovels over the machinery. That was the only reason I could see why he would want to use it.

X Q. 283. It splashed your clothes pretty badly, did it not?

A. Oh, yes, but that was when he was dumping it to another section. Remember there was a line of machinery partially along on the east side.

The Court: Why would not a funnel have been just as well?

The Witness: You mean a large funnel?

The Court: Yes.

The Witness: Your Honor, I will have to digress just a minute. If you knew George W. Jackson you would know anything he did——

The Court: I am not saying what he would do, or the characteristics of George W. Jackson. I am asking you why it would not have done just as well.

The Witness: I would have taken and covered the machine with a few planks, and thrown a tarpaulin over it and [fol. 107] put a little spout in there and shoveled the concrete into the spout and into place, like an ordinary man would have done.

X Q. 284. Can you state what the discharge pipe of this apparatus was made of, this Jackson apparatus which you have testified about?

A. It was what we call spiral riveted pipe.

X Q. 285. And how about the part of the pipe that you say went up and down over something and down again?

A. Do you mean what we call the goose-neck?

X Q. 286. Yes.

A. That was all spiral riveted pipe.

X Q. 287. And this bag on the end of the pipe, what was that made of, do you remember?

A. Just an ordinary burlap or cement bag.

XQ. 288. Can you make a sketch of that basement in which you say this machine was used, and indicate on that sketch where the underpinning was done and where the floor was laid, and where the machinery was located?

A. I think I can describe it to you.

X Q. 289. I would like for you to make a sketch. I will hand you a piece of paper.

A. (Witness does as requested.) You appreciate this will not be to scale. It will be perhaps indicative of what was there.

In order to save some sketching, I will say that the entrance to the building was practically in the center of the building, and then passing in on the first or ground floor to the right of which was some clerical help, and a short way back was the elevator, then just in the rear of this elevator was a stairway, which led down to the basement. [fol. 108] That I am merely explaining so that you will understand. I am going to leave off getting to the basement. See whether this will answer your purpose. This is East Monroe Street at the bottom of the page. North is to the back which I will indicate by an arrow. Along the west wall there were various machines, whether they were permanently installed there or not, of course, I do not know. There were several machines along in through about not quite the middle, a little bit to the west of the middle of the building itself.

There were some columns coming down at various points along in through what would be the middle of the building. This is really a single building but built on two lots, possibly 50 feet frontage. Whether it is 50 feet or 40, I do not know.

The concrete mixer itself was installed slightly to the north and practically, well, I will say not more than five or six feet west of the center of the building.

X Q. 290. Well, just make an "M" there to indicate where the mixer was.

A. We will put it right here. Now, you asked about the concrete which was put in. The first concrete which we put in and which I saw being put in, and which I am telling you was splashing where I got my decorations, ran over this series, or the pipe ran over this series of machines which I will call No. 1, and deposited in due course to the machines practically taking up that bay between the machines along the west wall, and thence running down just west of the center. I will indicate the outlet of that pipe [fol. 109] approximately by the circle there.

X Q. 291. Better mark the pipe P or something like that.

A. All right. I will mark the pipe P, and mark the outlet O.

I will not necessarily indicate the box in which that was dumped. You will understand that that box was below. That was the first piece supposedly, and I will shade ap-

proximately the cross arch or the piece of flooring which I saw put in, centering, let us say, roughly around this end of the pipe which I have marked O.

X Q. 291. And how big was that piece of flooring?

A. This west half of the building is approximately 25 feet wide. The machines, the ones marked No. 1 there have a space of about 4 feet; and the machines along the west side there, I will mark those No. 2, were set about 2 feet or possibly a little bit more from the wall, and I will say that they probably averaged 30 inches at the foot, 30 inches across, in that neighborhood.

X Q. 292. Were they concreted in at the base, the machines?

A. My recollection is that those were, and many of them were on skids. Now, whether it was pieced under, I do not know.

X Q. 293. Now, indicate where the underpinnings started.

A. Now, when I saw the underpinning done this pipe was swung over to the west. Supposing I indicate it with a dot. Understand that there are bends and one thing or another in there, but roughly it is shown as indicated by the dotted line, and we will call it G for that pipe.

[fol. 110] That underpinning was along on the west wall back of where I have labelled the various machines No. 2. Roughly, I should say, all I saw them do was ten feet or so, possibly, of that underpinning.

X Q. 294. And did that underpinning run the entire length of the wall?

A. That I do not know. As I said, I saw them do about 10 feet of it.

X Q. 295. And this patch of concrete that you say you saw them do was about what size, approximately?

A. This was about 5 feet. Roughly, that would be between 10 and 15 feet. I should say 15 feet, closer to 15 than 10 feet wide, and about 20 feet long.

Understand, Mr. Cox, I am not going to say that I saw the whole of that piece put in. That is where they were working.

X Q. 296. How near the front of the building was that patch of concrete floor?

A. Well, I would say approximately that that was about a little bit north of the center of the building. My recollection is that these buildings are about 125 feet in depth.

Mr. Cox: Now, I will have this sketch marked for identification.

(Marked Plaintiff's Exhibit No. 10 for Identification.)

X Q. 297. Now, as I understand your testimony, Mr. Artingstall, you have no drawings, sketches, description or photographs of this machine that you say was used by Jackson in 1903?

A. I would be inclined to say no—oh, Jackson's 1903?

[fol. 111] X Q. 298. Yes.

A. I do not know whether I have or not. I have not looked for any.

X Q. 299. Did not defendants' counsel ask you to look for such things?

A. No.

X Q. 300. Did not ask you to look for any drawings, or sketches or photographs or any part of this machine that might be in existence?

A. No.

X Q. 301. Do you know whether the drawings or not were made at that time?

A. That, I do not know whether they were or not. You see I was not connected with Jackson at all.

X Q. 302. You were a friend of Mr. Jackson, were you not, and met him quite often?

A. Oh, yes.

X Q. 303. Did not you learn in the course of your relations with Mr. Jackson whether he did have a drawing or a sketch or description made of this machine?

A. Oh, no, not any more than I would learn when I would go out to the bridge shop and ask him for the blueprints of the piece of work he was putting through the shop. I was not interested particularly whether he had any drawing or not.

X Q. 304. Then you do not know whether any drawings were ever made or any photographs or other illustrations of this machine?

A. Not of my own knowledge, no.

X Q. 305. And you have not tried to find out?

A. No.

X Q. 306. Have not you asked, Mr. Artingstall——

A. Let me just correct that a minute. I called Mr. Slade who is now engineer for the Chicago Tunnel and was connected with Jackson a number of years, and went with the [fol. 112] Tunnel Company, either connected with Jackson or the Tunnel Company for a good number of years, and I asked him if he had had anything relating to the machine. He said that they had nothing going back to 1907. I think it was 1907 when the Chicago Tunnel Company superseded the Illinois Tunnel. In other words, their records started with the present concern, not the old.

X Q. 307. Why did you ask Mr. Slade?

A. Why did I ask Mr. Slade?

X Q. 308. Yes.

A. Because I knew that if anybody had it Slade was the man that would have it.

X Q. 309. Was Slade connected closely with Jackson at that time?

A. Yes, very closely.

X Q. 310. And knew what Jackson was doing?

A. Slade was really Jackson's office engineer, I think.

X Q. 311. Is Mr. Slade here today?

A. I have not seen him.

X Q. 312. Did not you ask him to come here?

A. No, I have not. Why should I ask him?

X Q. 313. Did not defendants' counsel ask you to hunt up corroboration or something like that in this case?

A. They asked me if I knew anybody else that might say anything about this, and I said that the only one I knew would probabyl be John T. Fanning or Slade. I called Slade, and he said, "No, I have not got any records." Slade is a very, very old man and very feeble, and I talked to him over the phone.

X Q. 314. Do you think he could stand a trip from Chicago to New York?

A. Well, the best way to do is to ask him.

[fol. 113] X Q. 315. You did not ask him that?

A. Understand, Mr. Cox, I am not gathering witnesses on this case; I have no interest in it.

X Q. 316. Did not you receive a fee for your services and giving this information?

Mr. Johnson: I object to that.

X Q. 316. (Continuing:) In connection with giving this information to the defendants?

The Court: Overruled.

A. Yes, I have received a fee for my services.

X Q. 317. You received a fee last June when you gave them this affidavit, didn't you?

A. Yes, afterwards.

X Q. 318. Now, what is Mr. Slade's position now?

A. As to his exact position or title, I could not say, but he is engineer for the Chicago Tunnel.

X Q. 319. That is the company or the successor to the company or companies that have been building this tunnel right along, is it not?

A. Yes, building or operating it. In other words, they are all the same. What the legal applications are, I do not know.

X Q. 320. During the last 23 years since 1903 you have seen a great many concrete machines, have you not?

A. Quite a number.

X Q. 321. You have seen concrete mixers, too, have you not?

A. Of various kinds.

X Q. 322. You have seen, for instance, the Koehring concrete mixer, haven't you, during the last twenty years?

A. A cubical mixer?

[fol. 114] X Q. 323. No, the Koehring mixer, a round drum?

A. Yes, I know what you mean.

X Q. 324. Do you remember anything about the construction of that?

A. Let me see. That is the one, if I am right, with the various vanes in the inside of the drum.

X Q. 325. Have you ever seen a drum cylindrical concrete mixer that did not have concrete vanes on the inside?

A. Not lately. There were some a number of years ago.

X Q. 326. At any rate, you do not remember how the discharge chute or the vanes of the concrete mixer manufactured by the Koehring Company in Milwaukee and used extensively in Chicago are arranged?

A. No, I have not been interested particularly in what we might call the open batch mixers. The only thing, so

far as the machinery would interest me, is where it might be unusual, or of such a type as this, or such a type as one of the old gravity mixers, which was a spout with various arrangements of pins through it.

X Q. 327. You have also become during the past fifteen years or so very familiar with the operation of pneumatic mixers, haven't you?

A. No.

X Q. 328. Placers and conveyors?

A. No. I only used a pneumatic mixer at one time.

X Q. 329. You became familiar in 1911 and afterwards with the construction and operation of the McMichael machine, the McMichael pneumatic conrete mixer?

A. Well, as I said, the only experience I personally have had with the pneumatic conveyors was on that La Salle job in 1911, running into a little bit in 1912, the early part of 1912.

[fol. 115] X Q. 330. Now, on this job in 1911 and 1912, had McMichael used that machine before you made the suggestion which you say you made on that job? Had he used it on that job?

A. Had he used it on the job?

X Q. 331. Yes.

A. He used it on the opposite side of the river as a grout machine.

The Court: Are you referring to this?

Mr. Cox: No, I am referring to the machine here shown, the McMichael machine.

X Q. 332. Now, then, prior to the time of this suggestion which you testified to, McMichael had not used the machine on that job in 1911 and 1912; is that right?

A. No, I think he used it on the opposite side of the river with the grout machine.

X Q. 333. Never mind about that.

A. That was the first time that I had seen his machine in actual work.

The Court: That was in 1910.

The Witness: 1911, your Honor.

X Q. 334. I believe that you have stated you were the engineer on the La Salle Street job?

A. I was.

X Q. 335. Were you the engineer there or was it your father?

A. No, I was. Well now, wait a minute. There were two or three different operations on the La Salle Street Tunnel. One in 1886 was my father.

X Q. 336. I am talking about this job in 1911 and 1912?

A. On which this work was done?

[fol. 116] X Q. 337. On which the McMichael placer of Exhibit F was used?

A. That was my own.

X Q. 338. That was your job?

A. That was my job, yes, design and specifications and superintendence for the Board of Supervising Engineers.

X Q. 339. Mr. Artingstall, I believe it is your testimony that in 1911 you told Mr McMichael to put the air jet at the bottom, as shown in this Exhibit F. Where do you say he had that jet prior to the time when you told him that?

A. As far as the outward appearance of the machine is concerned, there was no further connection other than the one which is marked No. 1 entering at the top of the machine itself.

By the Court:

Q. 340. The answer is before that it had been at the top?

A. Yes.

By Mr. Cox:

X Q. 341. And no jet entering the machine except at the top?

A. That was all.

X Q. 342. Do you know whether that was the machine that he had previously used for grouting?

A. This machine here (indicating)?

X Q. 343. Yes.

A. That machine is the same machine which we had on the other side of the river. This picture shows the north side of the river. We used it on the south side of the river as a grouting machine. But we had considerable trouble even with this pipe P.

X Q. 344. It was your opinion that the trouble with the machine was that it did not have a jet except at the top?

[fol. 117] A. I suggested that he could eliminate some of the crowding at the bend, pipe P, by tapping it and putting that additional jet in at the bend.

X Q. 345. Did not Mr. McMichael say anything to you about having done that before, on previous machines?

A. No, as far as I know, this was the only machine that McMichael ever built. I do not know whether he ever built any before or not.

X Q. 346. In your statement in this Western Society of Engineers' article, which I believe is marked H for identification, you say, "From that time on it was dropped until about 1907 or 1908, when the Drake Machine Company here in Chicago took it up and started to improve it." Now, that refers, as I understand it, to this Jackson machine that you have described and which you have shown in Fig. 2 of Exhibit E? A. Yes.

X Q. 347. So that the machine, whatever it was, used at the time you have testified to, say it was 1903, was dropped until 1907 or 1908?

A. So far as the machine of the same type shown in that Fig. 2 on Exhibit E.

X Q. 348. Did you see any of the work or tests that went on at the Drake Machine Company in 1907 or 1908?

A. I was over at the Drake Machine Shops possibly—well, to be conservative, say three times. The reason for that was this: The McGovern Company had ordered this machine from the Drake Company or from McMichael. Now, it was over at the Drake Machine Shops and they were having considerable difficulty in making any kind of [fol. 118] delivery. To be frank, Mr. McMichael was his own worst enemy, and it was very hard to catch him. I went there on a number of occasions with the superintendent for McGovern, to be conservative, say, two or three times. That was practically the sole contact I had with McMichael's machine until it was delivered on to the job.

X Q. 349. And then the machine that you saw at the Drake Company in 1907 or 1908 was the machine that Mr. McMichael was making?

A. It was later than that. It was this same machine here.

X Q. 350. The same machine shown in Exhibit F?

A. Yes. That was brought directly over from the Drake Machine Shops.

X Q. 351. I believe you have stated in substance that concrete discharged from this machine such as that shown in Exhibit F is mixed with the air that is fed into the machine?

A. No question about it.

X Q. 352. That is your testimony?

A. Yes.

X Q. 353. How does that air get out of the concrete?

A. It gets out of the concrete when it is discharged at the end of the pipe.

X Q. 354. While it is passing through the pipe, you mean?

A. No, at the end. It is a part of the force until you get the mass deposited in the place where you want it. You can see that when you deposit it, dropping it, for instance, into this box that you spoke about at the end of this goose-neck pipe called H there. When the mass of concrete was dropped down in there from the pipe, the concrete itself was bubbling right up.

[fol. 119] X Q. 355. That is the way, in your opinion, that the air got out of the concrete that you observed?

A. There is no other way for it to get out. I am just going to qualify it to make it clear. There is no other way for the air to get out providing that there is not an excess of air transmitted through the discharge pipes.

For instance, if your concrete had already been discharged through this 16 and your valves C and E still open, you would be discharging the air out of them (witness referring to Fig. 2 of Exhibit E).

X Q. 356. But concrete is a rather sticky substances, is it not, always?

A. No.

X Q. 357. You referred to an emulsion of air, I think. What did you mean by that?

A. I said that it could be termed, the mass is emulsified. In other words, each individual particle had more or less of another substance around it. That is, the air is doubtless around every one of the particles, whether it be stone or cement or sand, more or less.

X Q. 358. That air must get out of the concrete or else the concrete will be defective and have flaws in it?

A. If the air was still ingrained in the mass after it was in place, most assuredly.

X Q. 359. And then the air would have to get out of the concrete by simply rising as bubbles of air do in water to the top?

A. Yes, that is what gives you latence on the top of your concrete.

By the Court:

Q. 360. You talked at one time of the formation of some kind of an emulsion between this air and this water and the cement and any gravel or stone that was in there?
[fol. 120] A. Yes.

Q. 361. And you talked about some flotation principle. You do not regard the propulsion of this mass through a tube in order to deposit it in some place, whether below or above, as really flotation, do you?

A. I most certainly do, your Honor, and I will show you why——

Q. 362. I will give you plenty of chance to show that. But this air that gets in there is all mixed up.

A. Is mixed up with the concrete ultimately.

Q. 363. How can the air be pushing when it is mixed up? Has it not got to be pushing from behind?

A. Not necessarily.

Q. 364. I mean unless there is a stream of air. Of course, if there is a stream of air, that scatters the thing the way it would dust. I can see how that can propel grout as it might propel dust, but I do not see how a certain emulsion formed by the introduction of air could have an accelerating effect.

A. That is just exactly what it does do, and the comparison with dust can very well be taken because the air which is in the mass—first, let me say that the air is behind the mass.

Q. 365. The air is behind the mass, and that pushes it?

A. It comes down through here (indicating) through the bottom of the opening G of Fig. 2 of Exhibit E. The mass is then carried along the pipe H. That comes down before it is what I call emulsified or mixed up. Let it come down as a slug or piston. It enters into this pipe H, coming along through the right and toward the discharge end. What happens? In front of that slug is a pressure which [fol. 121] is absolutely uniform over the entire area of the

pipe. Behind it, just at the starting point, is an air pressure which is absolutely uniform but greater in extent than to the advance of that particular plug.

What is there to prevent that from being carried along uniformly as a slug? Merely this: As the mass is carried along the pipe, the only difference between the pressure on the front of the slug and any point from the center to the periphery or outside is the fact that there is a friction on the outside of the mass.

Q. 366. The pressure where?

A. On the slug.

Q. 367. From behind?

A. From behind.

Q. 368. All right, I understand.

A. The slug has taken the position of a cone. In other words, the center is advancing more rapidly than the outside. It can only go a certain extent and before the center becomes the outside and what is now the outside becomes the center, there is a continual whirling out and that is shown very evidently if, as was done in the McMichael machine at the Drake Company, when he put cement bags into the machine and passed them out twisted and turned and some of them even turned inside out.

Q. 369. You mean that by reason of this friction and the more rapid advance of the inside, the outside finally collapses? *A*. Why does the outside become the inside?

A. Because the pressure is relieved on the point of the cone which is then necessarily brought to the outside of the tube. If that was not true——

[fol. 122] Q. 370. You mean the friction relieves the pressure?

A. Yes, sir, and if that was not true, what would happen would be ultimately that this slug would be drawn out—if we will say it is a thousand feet long—this slug would be drawn out to an infinitesimal thickness and come out not as a big puff, but it would be drawn out ultimately like a slow flow of water.

Q. 371. How does the air get in there so that it is pushed by air behind? You say that it is a flotation principle, that the air behind is bearing against the slug all the time. If air gets introduced into this slug, I do not see what that is

except just a particle or particles of air in there. I should not think they would have any velocity.

A. They must have velocity.

Q. 372. The velocity of the air being carried along to the whole mass, but they are not pushing the mass?

A. They must, your Honor, because if they did not—what would happen if they did not do that? You would have this slug started with no pressure on the front of the slug and an enormous pressure on the back which would merely tend the same as you and I would do with a hammer hammering a piece of wood. We put the dent into it, solidify, in other words, the area around the head of the hammer. We would not interfere with the bottom part. Supposing we take a hatchet. What do we do? We cut through those grains of wood and it spreads out as far as their force will take it. That, as I see it, is this thing here.

Q. 373. I may be dense, I may be wrong about it anyway, but I do not see yet how this air which is introduced there [fol. 123] floats in it.

A. Your Honor forgets, or does not probably appreciate the technical point that the air at the back which is being introduced into the mass is of a greater pressure per square inch——

Q. 374. I understand that. That pushes.

A. Yes, sir. Now, then, let us say that the first cubic inch of air that got into the mass is propelled along a foot. It is dissipated. But we have got dozens of others, hundreds of others, cubic inches coming along pushing this same mass along. That is the reason I say there is an emulsification of the mass by the air.

By Mr. Cox:

X Q. 375. What velocity does the concrete have passing through the discharge pipe of one of these placers?

A. It depends entirely upon the unit air pressure and the capacity of the quantity of air which you insert into the machine or through the valve E.

X Q. 376. It has a velocity running up to a hundred feet a second, has it not?

A. It may. It depends altogether on how much unit pressure you put in.

X Q. 377. Your statement is that while that mass is moving at that terrific rate and the air is pushing at that, the air at the same time becomes emulsified?

A. Certainly.

X Q. 378. Your theory is, then, that a slug is formed at the outlet of the vessel, and that comes under the influence of the air at the bottom, and then this emulsifying [fol. 124] action takes place as it is going along the discharge content?

A. I did not say that my theory was that there was a slug formed. I merely presented that for his Honor's information.

X Q. 379. It comes down from the main vessel in slugs, does it not?

A. I can not conceive of it coming down in slugs, no. It is against all principles of mechanics to even imagine such a thing.

X Q. 380. Then your theory is not that there is a slug that the air breaks up at all?

A. As I said, I introduced the main slug, whether it means six inches in diameter or one inch, merely to exemplify for his Honor the fact that there was a certain piece of concrete in there.

X Q. 381. A certain mass of concrete is forced down into the discharge outlet, whether it be a foot long or two feet long or a few inches long; is that it?

A. There is a continual dropping of the mass in here into the pipe.

X Q. 382. Is it not your theory that the pipe is filled as the material rushes along? Is it not your theory that the pipe H is practically choked?

A. In a way, yes. The very fact that this valve C must be opened before the valve E in order to increase the pressure on the top and start that thing down, tends to keep the pipe H filled.

X Q. 383. Then the pipe H is practically choked throughout the entire length of the discharge pipe; that is to say, it is closed by the concrete; is that right?

A. No, I said it would not be absolutely closed. It is choked so far as the quantity of the mass of concrete coming from the mixer can do so.

X Q. 384. It is practically closed so that there is no free [fol. 125] passage of air through it?

A. I would not say that there was not some free passage of air through it. There may be a small amount, because you can not fell—I am only going to cite my own experience. The only way you can tell is that there is a certain amount of air comes out here before your concrete comes. Whether that is the air which is in the pipe alone——

X Q. 385. The air in the pipe must be forced out first, must it not?

A. Whether it is that air which is in the pipe alone or whether it is some of the air which was under pressure and either came through the valve C or the valve E, I would not state.

X Q. 386. After the concrete starts to come, then there is none of that free air coming out?

A. There is always some, because if your pressure at the rear did not exceed your pressure at the front, you would not have sufficient force to carry that concrete out.

X Q. 387. I mean there is no discharge of air through the concrete as it comes out?

A. The very fact that in this particular machine we have to put a bag over the top of it shows that the minute it was let out of the pipe, there was an expanion in all directions.

X Q. 388. If concrete is compressed under 100 pounds pressure, it will expand when released?

A. I can not imagine concrete being compressed to any such extent as that.

X Q. 389. If the pipe is not choked by the slugs of concrete, or whatever you may call them, what prevents the air from blowing through and exhausting the pressure?

A. The very fact that there is a cohesion or adhesion be- [fol. 126] tween the different layers of the concrete.

X Q. 390. That cohesion forms a mass which practically chokes the pipe?

A. No, that cohesion or adhesion may be broken up more or less by the air.

X Q. 391. You know that the pressure in the air supply on the top of the machine and on the jet at the bottom of the machine in any of these cases does not drop very materially during the discharging operation?

A. I will not agree with you on that because that depends altogether on how quickly you close the valves C and E.

X Q. 392. I mean while the discharging operation is going on, the pressure does not drop; the pressure is maintained on the machine?

A. The amount of air, that is, I mean absolute quantity which you use, is going to depend first on how far you want that material to be carried, and secondly how quickly you can close those valves after it has gone through.

Q. 393. I do not mean that. I mean when the machine is full and you turn on the air and the concrete in the machine is discharged, the pressure does not drop until the batch has been shot out?

A. I have seen it drop quite considrably, yes.

X Q. 394. How considerably, how much?

A. Take it, for instance, on this job here, Exhibit F, the pressures which we used varied, of course. Sometimes it would be higher and sometimes it would be lower. But I would say as an average the pressure would run between 50 and 60 pounds. I have seen it drop 20 pounds.

[fol. 127] X Q. 395. As much as 20 pounds?

A. Yes.

X Q. 396. As much as one-third?

A. As much as one-third. That was one of the difficulties of the machine.

X Q. 397. If the pipe was open, it would drop to nothing, would it not?

A. Yes, I have seen the head of the receiver blown off.

Redirect examination.

By Mr. Johnson:

R. D. Q. 398. Mr. Artingstall, just on the very line that you have been examined about, I would ask you what you mean by "emulsification"?

A. "Emulsification" is really the surrounding of one material by another, different kind of material. In sand, for instance, we could emulsify the sand by surrounding it with water, with a thin coat of water.

R. D. Q. 399. My question is too broad. I mean the emulsification of the concrete, getting it down to this state.

A. In that case I used, as you might say, a simile or a

picture. To confine it just to the other extreme, I would say that there is a mixture of the air with the concrete, of the air in different parts of the mass with the concrete.

By the Court:

Q. 400. Suppose you have an emulsion—I do not know whether you have taken any interest in that—but you have an emulsion in the carburetor, of air with the gas. That is one of the great problems, to get the mixture right. But there, as I understand it, the air performs no office at [fol. 128] all when they introduce it except to furnish the chemical that makes the proper combination. The movement of the gas or of the emulsion which they always really have to have is due to the suction at the other end of the big fan. I do not know whether the air floats anything. The air is pulled just as the gas is pulled, but that is a true emulsion in that case, is it not?

A. Yes, that is really a true emulsion.

Q. 401. It is called an emulsion?

A. Yes, we call it an emulsion. The gases are surrounded by the air—for what reason? So that when you get into the cylinders, you have your compression that is broken upon the oxygen of the air combines with your gases.

By Mr. Johnson:

R. D. Q. 402. Mr. Artingstall, to come back to your concrete, if I understand your testimony correctly, when a certain quantity of concrete comes down through this (indicating), between G of Figure 2 of Exhibit E, the air pressure or air, rather, from the pipe F picks up that certain quantity of the concrete and goes into it and emulsifies it; that is, the air is worked into that liquid concrete; is that right?

A. Yes, there is no question about that.

By the Court:

Q. 403. You think there is enough air all through it so that the air stream, so to speak, continues——

A. There is no question about that.

Q. 404. From this compressor or whatever it is?

[fol. 129] A. Yes, there is no question in my mind about that for this reason, your Honor——

Q. 465. Of course, the air would carry it if there was a sufficient air stream to float it going all the time, I mean if it broke up the other enough so that there was as much or more air than you dropped.

Mr. Johnson: As I understand the proposition, that is exactly as this thing operates.

By Mr. Johnson:

R. D. Q. 406. Is that your understanding?

A. I was going to say that is true for this reason: When you take an ordinary cylinder of this kind which is comparatively high with the opening in the bottom, what happens? This feeds out uniformly, but you get a cone working down from the center and the center of your mass goes out long before the sides do. In other words, whatever the material may be that is piled up, the material along the sides, which was at the same elevation as in the middle. center of the material makes its exit before the material on the sides, which was at the same elevation as in the middle.

Do I make it clear?

R. D. Q. 407. Yes. If I understand you correctly, there is not only air under pressure in pipe F, but there is a sufficient quantity of air under pressure to float the concrete that drops from the bin A and force it out through the pipe H by floating it in the air; is that right?

A. Yes. There has got to be sufficient air. If you car-[fol. 130] ried it to the absurdity and added, let us say, one pound of air, the material would drop into this pipe H and stop there, that is all.

R. D. Q. 408. If it was not floated out and impregnated with air, say a solid cartridge of concrete came down through the opening G and was cut off by the air in the pipe F and that cartridge was moved right along the exit pipe H, what would you get at the exit 16? No floatation or anything of that kind? I am taking that cartridge right through.

A. You mean just traveling uniformly?

R. D. Q. 409. Yes.

A. You would have continual wads being dropped out one after the other. I can not conceive of that and I will tell you why. Supposing that we had a wad here just at the connection of the pipe G or the opening G and the pipe H, and we had another one, let us say 2 inches ahead of it——

R. D. Q. 410. In the pipe H?

A. In the pipe H. Then, as I showed you before, with the uniform pressure entirely across the area of the pipe H, the center of the first slug is going to advance or is going to proceed in advance of the material on the periphery of the outside of the pipe—that is, not outside of the pipe, in contact with the pipe. The second slug, that is, the one that has entered the pipe H after the first one has gone along, is undergoing that same procedure. The center is going faster than its periphery. What is happening? The front of your second slug is catching up with the tail end of your first slug, is it not, and your outside is then mixing with that and you do not have any slug.

R. D. Q. 411. When you say "mixing" you mean mixing [fol. 131] with the air in the pipe, do you?

A. I mean the two slugs mixing together, if such a thing were possible, if it were possible for two or three or a dozen slugs to come down one after the other.

R. D. Q. 412. In the actual operation of this structure that you saw in 1903, the machine represented by Figure No. 2 of Exhibit E, did any slugs or wads come out of the exit pipe 16?

A. The only wads that came out of that pipe was when we ran some concrete bags through it.

R. D. Q. 413. And the rest of the time what came out?

A. Just a uniform mass of concrete.

R. D. Q. 414. Liquid concrete or dry concrete?

A. Very liquid.

R. D. Q. 415. Is that also true of the McMichael machine, Exhibit F?

A. I would say that the concrete which we used in the so-called Jackson machine was as nearly identical with what we used in McMichael machine on the concrete.

R. D. Q. 416. And that was what?

A. Very liquid concrete.

R. D. Q. 417. Would any slugs or wads come out of the exit pipe of the McMichael machine, Exhibit F?

A. No, I never saw any.

R. D. Q. 418. And you saw that operated?

A. Yes.

R. D. Q. 419. You were cross examined as to certain air being admitted into the chamber. Do I understand that that mixer on chamber M was shaped like the McMichael patent on Exhibit F with two air inlets, one in the patent marked pipe 8 and the other pipe 10, having its lower end down in the copper and apparently marked 2, although as a matter of fact it has no number?

A. No, there was only the one pipe entering at the top [fol. 132] which I marked No. 1. The addition which we put in was this which was marked No. 2 (referring to Exhibit F).

R. D. Q. 420. If I understand you correctly, then McMichael in 1911 built Exhibit F with only an air opening for air under pressure above the mass; is that all?

A. That is all.

R. D. Q. 421. That is, in 1911, he built this machine, Exhibit F, without two air lines as, for example, in his patent pipe 8 and pipe 10. In other words, he only added the equivalent of pipe 8; is that right?

A. Yes, he had only the one pipe at the top, that is, the one air pipe coming in at the top of the machine.

By Mr. Cox:

R. X. Q. 422. And that is the machine he had been using for grouting?

A. That is the same machine we used on the other side of the river.

By Mr. Johnson:

R. D. Q. 423. But you used this also for concreting, did you not?

A. Yes, sir.

R. D. Q. 424. Simply by adding gravel to the mixture?

A. We use stone.

R. D. Q. 425. Of how big a diameter?

A. The diameter was limited to one inch.

R. D. Q. 426. There was no difference in the structure at all after you added the lower jet 4?

A. No difference.

R. D. Q. 427. And after you added the lower jet 4, inserted or added to the McMichael construction, Exhibit F, then you could use it for wet concrete?

A. Yes. As I stated before, we had trouble with the grout clogging down here in this pipe P right here at the [fol. 133] elbow when the machine was used on the other side of the river. That pipe P, when we first used it, was a spiral, what we called a spiral riveted pipe like galvanized iron. Of course, it was not very heavy, and naturally it wore out. So when this elbow was made as a special casting, as we term it, this connection No. 4 was put in. It would have been utterly impossible to put this in the galvanized pipe and make it tight.

R. D. Q. 428. Somewhere in your cross examination, you were asked about the statement that in your affidavit you said this opening G was four inches, and I think in your testimony you said it was six inches and Mr. Cox contrasted your affidavit of June 8th, 1926, with your testimony of yesterday. I hand you your original affidavit of June 8th, 1926, and ask you who made that sketch in paragraph 11?

A. I made that sketch myself.

R. D. Q. 429. The sketches in portion of paragraph 11. Whose writing is this? Whose lettering is it on this sketch?

A. That is mine. I did those.

R. D. Q. 430. Whose notation is "4 inches or 6 inches about"?

A. That is mine.

R. D. Q. 431. I will therefore ask you if figure 2 of Exhibit E does not correspond absolutely with the sketch that you made yourself in your affidavit of June 8th, 1926?

A. It does in that except we added that goose-neck to it yesterday at the end of pipe H as a continuation of pipe H.

R. D. Q. 432. I will then ask you if there is any contradiction in your affidavit and your drawing and your testimony about 4 or 6 inches.

[fol. 134] Mr. Cox: I object to that. That is all on the record.

Mr. Johnson: I want to bring it out; that is all.

The Court: Overruled. You may answer.

A. I stated yesterday that I said that that was 4 or 6 inches, and when I looked back and remembered that we

shot cement bags through it, cement bags are a pretty bulky proposition, and it is more or less difficult to run one of those things through a four inch, I would say six inches was the size of that pipe, of that opening G.

R. D. Q. 433. Mr. Cox has also cross examined you as to your fee in this case, the inference being of course clear. Have you a standard fee for your services by the day, per diem?

A. I have, yes.

R. D. Q. 434. And what is that?

A. $100 a day and expenses.

R. D. Q. 435. Was that the fee paid you by me last spring when I went over this matter with you?

A. Yes, sir.

R. D. Q. 436. Were you paid anything else?

A. Not a thing.

R. D. Q. 437. Is that the fee that you will receive for coming here, giving up your business and coming here and testifying in this case?

A. That is the fee I expect to receive.

R. D. Q. 438. And nothing else?

A. Nothing else, no.

R. D. Q. 439. Now, you were also cross examined about a portion of your affidavit, as I remember it, in which you mentioned 80 to 100 pounds being applied as air pressure, [fol. 135] and then I think you said 80 to 100 pounds in your testimony, and then Mr. Cox pointed out somewhere in your testimony you said 35 to 50 pounds air pressure.

Will you please explain that? Is that contradictory or not?

A. No, I think you just twisted it.

R. D. Q. 440. Just straighten it out then.

A. It was not contradictory at all. Both of them are right.

R. D. Q. 441. Will you explain that?

A. In my affidavit I said 60 or 80 to 100 pounds pressure. In my testimony yesterday, as I recollect, I said 35, 40 or 50 pounds pressure. That is perfectly proper. They are not inconsistent at all, because if I have 100 pounds pressure in the pipe J it does not necessary follow that I am going to put 100 pounds pressure in the cylinder B. I can explain that very clearly with a certain object. Just take

an inkwell, your Honor, and put 100 pounds pressure on the top of your rubber. It does not necessarily mean I am going to put 100 pounds pressure per square inch on the bottom of the inkwell, or to take it further than that, I mean I could take a lead pencil here and press on the bottom of that and my finger is indented, whereas, on the larger end of the lead pencil there is no indentation at all.

In other words, the pressure on the top is greater per unit of area than it is on the bottom, and so there is no inconsistency at all in the testimony as against the affidavit.

R. D. Q. 442. Do you remember that I asked you out in Chicago if you knew of anyone that would have drawings [fol. 136] of this machine Figure 2 of Exhibit E, and you gave me the name of an old gentleman that I went to see. I do not know his name. What was his name, do you remember?

A. I gave you the names of two. I gave you the name of Mr. John P. Fanning and Alfred Slade.

R. D. Q. 443. Yes, it is Mr. Slade.

A. S-l-a-d-e.

Mr. Johnson: Now, this is a statement, and I do not know whether you wish me to go on the stand or not.

I called on that old gentleman and he had no records back that far.

Mr. Cox: I must object to that.

Mr. Johnson: He gave me the name of this gentleman, and he said the records did not run back that far.

Mr. Cox: How about his memory?

Mr. Johnson: He did not remember; there was some use there.

Mr. McCaleb: He said there was something used there?

Mr. Johnson: He said there was a concrete machine used but he had no drawings of it, and he was a little hazy on the memory.

R. D. Q. 444. The other person was Mr. Fanning?

A. Mr. Fanning.

R. D. Q. 445. And he is here in the room?

A. He is present, yes.

Recross-examination.

By Mr. Cox:

Mr. Cox: My objection to Mr. Johnson's statement, as I understand it, stands but I just simply want it on the record [fol. 137] that that statement has been made.

The Court: If you object to it, I will strike it out.

Mr. Cox: I simply want the record to remain that he has made that statement, and I suppose the objection to it as evidence will be sustained.

The Court: I will strike it out if you want me to.

Mr. Cox: I would rather have it on the record.

The Court: All right; do not object to it.

Mr. Cox: My objection is simply that I do not want it to be part of any evidence in the case.

The Court: Strike it out then.

Mr. Cox: All right, let us strike it out and be done with it.

The Court: All right.

By Mr. Cox:

R. X Q. 446. Do I understand you to say now, Mr. Artingstall, that you shot cement bags through that Jackson machine that you say was used in 1903?

A. I said we shot, yes, we shot I think it was two bags through at one time. The first one went through as an accident.

R. X Q. 447. Now, did they shoot cement bags through the McMichael machine in 1907?

A. Yes,—no, 1911.

R. X Q. 448. Well, I understood you to say they shot cement bags through the McMichael machine in the Drake machine shop?

[fol. 138] A. Yes, that was in 1911.

R. X Q. 449. We were talking about 1907 when you said you saw some tests made in the Drake Machine Shop.

A. That was 1911.

R. X Q. 450. You now say that was 1911?

A. Yes.

R. X Q. 451. That you saw the experiments made in the Drake machine shop?

A. Yes.

R. X Q. 452. And you did not see any experiments made before 1911?

A. No, I did not see any in 1907, no.

R. X Q. 453. You did not see any before 1911 in the Drake machine shop?

A. No.

R. X Q. 454. Did not you say in your affidavit made in this case in June of the present year that:

"I knew John H. McMichael, patentee of United States patent No. 1,127,660, and saw him experiment with his pneumatic concrete machine placer in the plant of the Drake Machine Company on Western Jackson Boulevard, Chicago, Illinois"?

A. Yes.

R. X Q. 455. You made that statement?

A. Yes.

R. X Q. 456. Now then, in your statement made at the meeting of the Western Society of Engineers you stated that that was in 1907 and 1908, did you not? I show you a copy of that statement or I will read it to you.

A. Oh, I do not say in there that I saw those experiments in 1907 or 1908.

R. X Q. 457. Well, you do say, "from that time on it was dropped until about 1907 or 1908 when the Drake [fol. 139] Machine Company here in Chicago took it up and started to improve it"?

A. Yes, I made that statement.

R. X Q. 458. You stated on cross examination that that work was done by McMichael?

A. Oh, no, no, I did not. I said I saw this machine.

Mr. Johnson: Which one?

The Witness: Called Exhibit F in the Drake machine shop in 1911.

R. X Q. 459. Did you say on cross examination that the experiments or tests that you saw in the Drake machine shop in 1907 or 1908 were McMichael's?

A. No; I did not. I did not mention 1907 or 1908 anywhere on this thing.

The Court: What is that machine shop called?

Mr. Cox: Drake. I will refer according to the record.

R. X Q. 460. Now, Mr. Artingstall, I understand it to be your testimony now that the machine that McMichael used for grout on that LaSalle Street job was a machine without any bottom air inlet?

A. I do not say that. I said that the one which he delivered to us had the pipe P of a spiral riveted pipe. There was no air connection to that section of the pipe at all.

R. X Q. 461. Well, your testimony is that there was a top air inlet only on the machine used for grout on that LaSalle Street job, was there not?

A. Yes.

R. X Q. 462. And that is the only machine that was used [fol. 140] on that job for grouting, a machine with a top air inlet only?

R. X Q. 463. Do you mean of this type of machine? That is an air or conveying machine.

R. X Q. 464. Yes, an air machine.

A. Yes.

R. X Q. 465. That is correct?

A. Yes.

R. X Q. 467. Did not you say in this article that has been offered in evidence, the Journal of the Western Society of Engineers, November, 1911, under the heading, "LaSalle Street Tunnel," page 919, "The top was fitted with a hopper for the materials and separated from the mixer proper by an air-tight valve. When the hopper was emptied this valve was closed and compressed air admitted at the bottom, the top of the chamber and the junction of the latter with the 6 inch spiral riveted discharge pipe"?

A. I probably did, for this reason——

R. X Q. 468. You probably did?

A. Yes.

R. X Q. 469. That is all I want to know.

Mr. Johnson: Let him give his reason for it.

The Witness: My reason was this: At no point through any paper that I have ever written or any article or any time on which I have spoken to any society have I attempted to minimize what some other man has done.

In this same article I am giving credit to Messrs. E. C. and R. M. Shanklin for design of the river section which I had anticipated for two years before and applied for and got specifications.

[fol. 141] HARRY B. KIRKLAND, called as a witness on behalf of the defendants, being duly sworn, testifies as follows:

Direct examination.

By Mr. Johnson:

Q. 1. Mr. Kirkland, will you give your name, age, residence and work?

A. Harry B. Kirkland, I am 45, I live in Evanstown, Illinois; chief engineer of the Concrete Mixing & Conveying Company.

Q. 2. That is the plaintiff in this case?

A. Yes, sir.

Q. 3. How long have you been connected with them, sir?

A. Since 1913.

Q. 4. Did you ever write an article that was read before the Western Society of Engineers entitled, "The Pneumatic Method of Concreting"?

A. Yes, sir.

Q. 5. I show you the Journal of the Western Society of Engineers which has been marked for identification as Exhibit H, and ask you if that is the article that you wrote (handing magazine to witness)?

A. Yes, sir.

Q. 6. Do you know Mr. Artingstall who has just testified?

A. Yes.

Q. 7. He took part in the discussion of your paper?

A. Yes, sir.

Q. 8. This article described the pneumatic machines that your company was putting out and had manufactured?

A. Yes, sir.

Q. 9. It described the plaintiff's commercial machine?

A. Yes.

Q. 10. I mean the commercial machine of the plaintiff in this case?

A. Yes, sir.

[fol. 142] Mr. Johnson: I introduce in evidence now this Journal of the Western Society of Engineers of May, 1918, Volume 23, No. 5, copyrighted in 1918, and certified by the Secretary of the Journal of the Western Society of Engineers.

Mr. Cox: I object to this article for the reason that it is an attempt to introduce something to vary or affect the interpretation of the patent, in the form of a statement made by some person who was not speaking for the patentee, and speaking after the patent was issued. He is not shown to have represented the patentee at all.

Mr. Johnson: The evidence shows, your Honor, that he was the chief engineer of the plaintiff; in fact, this article says he is president and chief engineer of the Concrete Mixing & Placing Company of Chicago.

The Court: Is that the same company?

Mr. Johnson: Yes, that is the same company.

Q. 11. Is that the same company?

A. No, sir.

Mr. Cox: It is not the same company.

The Witness: No, sir.

Q. 12. What relationship has that company?

A. The Placing Company was a licensee of the conveyors.

Q. 13. Was it the sole licensee of the plaintiff company?

A. No, sir.

[fol. 143] Q. 14. Who was the other licensee, the Ransome Company?

A. Not at that time.

Q. 15. Did you have any other licensees at that time?

A. I think we did.

Q. 16. You testified in the Ulen suit, did you not?

A. Yes.

Q. 17. As to the operation and construction of the machine?

A. Yes.

Q. 18. And you testified as the chief engineer of the plaintiff company, did you not?

A. Yes, sir.

Q. 19. And you testified as an expert having a knowledge of the construction since 1913, did you not?

A. Yes, sir.

Mr. Johnson: Now, I offer it again.

Mr. Cox: This was a statement made by this witness when he did not represent the plaintiff, the patentee or the owner of the patent.

The Court: What is the purpose in offering this?

Mr. Johnson: It contradicts every contention that they make in this suit.

Mr. Cox: Of course, we deny that.

Mr. Johnson: Every contention is practically denied in this paper by the chief engineer of their company before any suit was started anywhere.

Mr. Morgan: It has an important bearing on the true principles of all these machines, and it is very illuminating as to the attitude of this plaintiff before the stress of any litigation.

Mr. Johnson: It is absolutely necessary to show the [fol. 144] different propositions and legs that they have stood on, here they have to take a different position from the other suit, and in that position they are met flatly by this article by their own chief engineer, and a man who has been with them since 1913.

The Court: I will overrule the objection.

(Magazine marked Defendants' Exhibit H.)

Cross-examination.

By Mr. Cox:

X Q. 20. Now, Mr. Kirkland, I would like you to examine this article which has just been offered in evidence and state whether there is anything in that article that you wish to explain to the Court.

A. Well, on page 325, I think it is an explanation of the process at that time when this was written and I had assumed that the concrete was merely dropped in the air and was conveyed on the air, but as time went on and we made more of a study of the proposition I became convinced that this was not a mere flotation process, but a pressure process.

That is actually the way it looked as I see it now.

X Q. 21. And subsequent to the delivery of this paper by you in 1918 did you make a study of the patents, the McMichael patent in suit?

A. Yes, sir.

X Q. 22. What has that to do with the tests which caused you to arrive at the conclusion just stated?

A. The fact that the air impinging upon the sub-masses of materials as they came from the hopper began to make [fol. 145] us see that it was not merely a flotation process, but was entirely a pressure process. Is that what you mean?

X Q. 23. Did you in connection with the study of the operation of the machine have your attention called to the statement in the Patent Office by McMichael during the prosecution of the application for the patent in suit in which he says, speaking of his apparatus:

"The air can act on the mass only by pushing bodily against large portions of it, and not by acting separately on the individual particles which comprise the mass"?

A. Yes, sir.

Mr. Johnson: What page is that?

Mr. Cox: I read that from the file wrapper of page 267 of the Ulen record.

Redirect examination.

By Mr. Johnson:

R. D. Q. 24. Just what do you mean by your last answer, Mr. Kirkland?

A. I meant I had my attention called to that part he quoted.

R. D. Q. 25. Well, suppose you did have your attention called then, what then?

A. Well, that indicates very plainly that it was a pressure process and not merely a flotation process.

R. D. Q. 26. Oh, then, as I understand you, it was your opinion that it was a flotation process as you contend, but you have changed your opinion in view of something that [fol. 146] occurred in the file wrapper in the Patent Office?

A. Well, up to that time I will not say that I had a very strong opinion about how the machine worked. We were engaged particularly in making the machine work commercially and up to that time I just merely assumed it was that without going into it.

R. D. Q. 27. Now, that we may settle down, Mr. Kirkland, and understand exactly any change that you have and the

different position now assumed by the plaintiff, will you tell me and point out just exactly what portion of your article in the Journal of the Western Society of Engineers, Exhibit H, you now repudiate?

A. Well, that part referring to the method.

R. D. Q. 28. I will have to ask you to point out specifically because I want to know just exactly what it is.

A. Well, it is on page 325 I said, beginning with the second paragraph on that page: "In loading the mixer the ingredients"——

R. D. Q. 29. Now, how far is it?

A. The rest of that page and to the end of the paragraph on the next page.

R. D. Q. 30. The end of the paragraph on page 326?

A. Yes.

R. D. Q. 31. The article is all right with that exception?

A. There might be other statements in here that I would not agree to now. I would have to read it through carefully.

R. D. Q. 32. I am sorry to bother you, sir, but it is very necessary to know just exactly what you now repudiate.

A. I think that is all unless there are some other statements in there that I have not read.

[fol. 147] R. D. Q. 33. Please look through it, Mr. Kirkland, so we will not have to thrash over the same ground again.

A. I think that is all.

R. D. Q. 34. Now, if I understand you correctly then, sir, the only portion of this article of yours entitled, "The Pneumatic Method of Concreting," appearing in Exhibit H, Journal of the Western Society of Engineers for May, 1918, and on pages 319 to 355 is the portion that you have designated on pages 325 and 326 as follows. I will have to read this into the record:

"In loading the mixture the ingredients, cement and water are usually placed in a measuring hopper so that when the hopper is emptied into the mixer the first commingling of the ingredients takes place. This first commingling is not particularly important, as it is very slight. When the air is turned on that portion of the batch, which is at the bottom of the mixer, in front of the conveying air jet, is first to move and is instantaneously followed by por-

tions dropping from above. As the mixer has the shape of an hour glass, the central portion of the batch in the mixer flows down first, and the portion in the sides follows in the stream from the upper part exactly as sand flows in an hour glass. During this operation the minging of the different ingredient parts causes the smaller ingredients to flow into the voids between the larger ingredients. As the portions of the batch drop into the lower air stream, which [fol. 148] has a velocity of about 5,000 feet per minute, these portions are carried along in suspension much as dust is carried along in a storm, except that the articles are much closer together. Although the speed of the air jet is very high, the speed of the concrete materials is much slower. The speed of the concrete varies according to the amount of voids in the materials which permit the air to pass through. The air in passing through the voids tends to carry with it the smaller ingredients; that is, the sand tends to fill the voids betwe-n the rocks and the cement tends to fill the voids remaining, and, as the voids become filled up with the smaller ingredients passing through, the speed of the mass increases, the pressure of the air behind the mass increases with the decrease of the voids in the mass, and the speed of the mass concrete increases.

"Now, in this explanation of the mixing process, I have assumed that the air velocity passing through the pipe is sufficient to keep the materials in suspension, and it is important to have a sufficient air pressure to keep the materials in suspension, because when the air velocity is reduced the materials simply roll and tumble along the bottom of the pipe. The concrete will also mix in this manner, but it is not conducive to good operation and makes a dirty pipe line, which is liable to become plugged. In shooting concrete, therefore, it will be found that with [fol. 149] an 8-in. pipe and with materials of the specific gravity of limestone, the pressure should not fall below 50 pounds, as the materials will then commence to drag along the pipe. Any air expended below 25 pounds is wasted when blowing concrete through an 8-in. pipe."

That is correct, is it not?

A. Yes, sir.

R. D. Q. 35. Now, you stated, Mr. Kirkland, I believe, that you have been connected with the plaintiff in this action since 1913, is that true?

A. Yes, sir.

R. D. Q. 36. And you were chief engineer from 1913?

A. Yes, sir.

R. D. Q. 37. When did your company first file an infringement suit based on the McMichael patent in suit?

A. Sometime after the war; I do not remember.

R. D. Q. 38. That is some time after 1918?

A. Yes.

R. D. Q. 39. Have you filed more than two suits, one against the Ulen Company and one against the present defendants?

A. Yes, sir.

R. D. Q. 40. Before or after the Ulen suit?

A. After.

R. D. Q. 41. So that the first suit you filed was the Ulen suit, is that right?

A. I am not certain whether the Ulen suit was the first one.

R. D. Q. 42. Well, it was either the Ulen suit or this present suit that we are now engaged in, was it not, one or the other?

A. No, I am thinking of another suit; it may have been filed before; I am not certain.

[fol. 150] R. D. Q. 43. You filed three suits?

A. At least.

R. D. Q. 44. And they were all after 1918?

A. Yes.

R. D. Q. 45. They were all after May 13, 1918, were they not?

A. Yes, sir.

R. D. Q. 46. They were after you read this article. "The Pneumatic Method of Concreting," before the Western Society of Engineers on May 13, 1918?

A. Yes, sir.

R. D. Q. 47. So that you were connected with the plaintiff company as chief engineer for some five years before you wrote this article in Exhibit H, the Journal for the Western Society of Engineers?

A. Yes, sir. You say, "as chief engineer." I was considered as a technical man in the early days.

R. D. Q. 48. You have just stated that you were chief engineer?

A. There was no official title in those early days.

R. D. Q. 49. You watched the operation of your pneumatic blower during the time that you were employed from 1913 up to 1918, did you not?

A. Yes, sir.

R. D. Q. 50. You were familiar with the way it operated?

A. Yes, sir.

R. D. Q. 51. And you had been familiar with it for some five years or more?

A. Yes.

R. D. Q. 52. You testified in this other suit, this Ulen suit, as chief engineer for the plaintiff company, did you not?

A. Yes, sir.

R. D. Q. 53. You are an engineer, are you, Mr. Kirkland?

A. Yes, sir.

R. D. Q. 54. A graduate of what college or school, sir?

A. I am not a graduate; I attended the University of Wisconsin for two years. I was elected to membership in [fol. 151] the Western Society of Engineers in 1910.

R. D. Q. 55. Are you a civil engineer or a mechanical engineer?

A. Civil engineer.

R. D. Q. 56. And you were a civil engineer in good standing between 1913 and 1918?

A. Yes, sir.

R. D. Q. 57. When you wrote this article?

A. Yes, sir.

Recross-examination.

By Mr. Cox:

R. X Q. 58. In the portion of this article that has been quoted by defendants' counsel, did you explain what you understood to be the mixing operation of the machine?

Mr. Johnson: I object to that, your Honor. It seems to me that the best evidence of that is this printed book itself. That is what he thought at that time.

The Court: I think it is. You examined him and cross examined him, and I will let him answer, but hurry up.

A. Yes, sir.

R. X Q. 59. And previous to that time in connection with the Wilson Avenue Tunnel, had you operated the machine without pre-mixing the ingredients?

A. Yes, sir.

R. X Q. 60. And what was the result of that operation?

A. The concrete came out well mixed.

R. X Q. 61. Was that what led you to assume that there was some mixing going on in the machine?

A. Yes, sir.

R. X. Q. 62. Can you say whether there was any mixing [fol. 152] that goes on in the discharge conduit, and if so, how?

A. Well, in that turbulent motion in the sub-masses as they move through the pipe, or as they pass through the pipe.

R. X. Q. 63. And where else does mixing occur in the machine? I mean is that all the mixing, or does mixing take place in some other stage of the operation?

Mr. Johnson: Your Honor, I do not want to object to this, but the article stands for itself, and it seems to me not what he thinks about it now after he has brought two suits.

The Court: Overruled.

A. Well, as the mass presses itself in front of the jet which detaches portions there must be some commingling in there to cause a beginning of the mixture.

R. X Q. 64. Well, I mean prior to that. You may be confused because I mentioned the discharge. I mean prior to the actual discharge of the contents of the vessel, does mixing take place in the vessel?

A. Well, as soon as the air is turned on it tends to seek the common pressure throughout the chamber, and therefore the air goes up with a violent rush which stirs the material in the machine.

R. X Q. 65. Up through the materials in the vessel?

A. Yes.

R. X Q. 66. And causes a violent agitation of those materials?

A. Yes.

[fol. 153] JOHN T. FANNING, called as a witness on behalf of the defendants, being duly sworn, testifies as follows:

Direct examination.

By Mr. Johnson:

Q. 1. Mr. Fanning, will you please give your name, age, residence and occupation?

A. John T. Fanning; 1128 South Harvey Avenue, Oak Park, Illinois; occupation, contractor and consulting engineer.

Q. 2. Were you ever connected with the Jackson & Cordett Bridge & Steel Works, and if so, in what capacity?

A. I was vice-president and general manager of the George W. Jackson Bridge & Steel Works.

Q. 3. What did that company manufacture? What was its business?

A. Well, they manufactured concrete floorings, steel works, and construction of all descriptions; they took contracts of all descriptions and built bridges and buildings.

Q. 4. How long were you connected with that company?

A. From its inception, I was one of its incorporators from its inception, and it sold out to Mr. George W. Jackson in 1906. From 1901 to 1906.

Q. 5. Did that company do any tunnel work or was it Mr. Jackson that did the tunnel work?

A. The company did tunnel work, too, for Mr. Jackson's office at that time, did all the tunnel work. He was chief engineer and general manager of the Illinois Tunnel Company.

Q. 6. And he was a member of your firm?

[fol. 154] A. He was also a member of the firm of Jackson & Cordett Bridge & Steel Works.

Q. 7. Have you had any practical experience in concrete construction, and if so, please state what.

A. I have had considerable. I have been around where they poured possibly upward of 400,000 yards.

Q. 8. Will you briefly give the location of each job and the yardage approximately you saw of concrete work you were employed on?

A. Well, I would say altogether about one hundred million dollars. That would include the collateral work. There are two open excavations and pile drivings, that would include all of that, but the jobs would amount to about one hundred million dollars.

The largest one was the Illinois Tunnel Company. During the time I was there they poured possibly two hundred thousand yards, and I was also consulting engineer for Mr. Jackson on his tunnel work, all mechanical operations.

Q. 9. Can you name any other concrete construction work that you were on?

A. Directly under my charge was about 5,000 yards for the City of Louisville; 5,000 for the Illinois Central Railroad Company; about eight or nine thousand for the Chicago & Northwestern Railroad Company. The Ford Motor Company, I was there during the time and examined and watched concrete there for 60,000 yards approximately, spending three years on it.

There were numerous small jobs, such as bridges, foundations and so forth in the City of Chicago, the North Avenue Bridge, the Randolph Street Bridge in connection with [fol. 155] the Northwestern. Quite a few jobs that come to my mind right now.

Q. 10. The jobs you are mentioning now are concrete jobs?

A. They are concrete. There was also a job I did for the Sanitary District, concreting in the crossing between Evanston & Wilmette, and also the bridge for the Milwaukee Electric crossing between Evanston and Wilmette. I put the foundation in for that.

Q. 11. Have you had any practical experience in pneumatic placing of concrete?

A. Some.

Q. 12. Please state what experience you have had in pneumatic placing of concrete?

A. Well, in the year 1901 Mr. Jackson asked me to come over to his office one night, and told me he was having a little trouble with leakage of air in the tunnel. The tun-

new as constructed under air; and he thought if he could get concrete behind or grout behind the concrete, he could plug up those leaks.

I told him in 1898 or 1897 I had built a machine for blowing wet sand, and I believed if I could blow wet sand, I could blow wet sand with concrete and cement in it, which was grout. So he told me to go ahead and see what I could fix up, so I got a little tank and put some valves on it and some pipes and attached air to it and tried it.

Q. 13. Did you make an affidavit in this case on June 8th, 1926?

A. Yes, sir.

Q. 14. There are certain sketches in your affidavit that I will ask you to examine and state whether you made those sketches?

A. I made them.

Q. 15. I have had a court exhibit made, and will ask you [fol. 156] whether or not the drawings on this court exhibit are identical except for size with the three sketches that you made yourself in the affidavit of June 8, 1926?

A. They are.

Mr. Johnson. For the sake of ready reference I am having Fig. 3 placed on the first sketch, Fig. 4 on the second, and Fig. 5 on the last one.

Q. 16. Will you please testify exactly what was the first pneumatic blowing of concrete or grout that you did, and indicate on this court exhibit if any of these sketches properly illustrate the machine you built at that time?

Mr. Johnson: There is no objection to offering this now before I examine this witness, is there?

Mr. Cox: He has identified it, has he not?

Mr. Johnson: Yes. The court exhibit just referred to is offered in evidence.

(Marked Defendants' Exhibit 1.)

A. The first one built was Fig. 3 on the exhibit.

Q. 17. You are talking about this one (indicating)?

A. Yes, but it did not prove very satisfactory.

Q. 18. Will you please describe in detail exactly how the machine illustrated by Fig. 3 operated and how you

used it, using proper designating letters or numerals. You had better come down here and put it on.

[fol. 157] A. They mixed grout separately from the machine, and then poured it into the machine in valve B so it went into the tank A.

The Court: Well, now, what is the Fig. 3? I mean he has three figures. What about 3?

The Witness: The Fig. 3 means this type of machine.

The Court: Is that the first one you made?

The Witness: That is the first one I made, yes; that is the first one. Then we opened valve B, and the air carried the grout out as far as it would, but we found there was quite a lot there that stayed in on account of the concave bottom.

Q. 19. Lettered what?

A. Tank A.

Q. 20. The concrete bottom?

A. The bottom of the tank.

Q. 21. No. 20?

The Court: So you made a convex one?

Mr. Johnson: That is the idea, yes, sir.

The Witness: So we then stopped immediately and reversed it as per Fig. 4. That operated a little bit different, but we found that the air had a tendency to keep the grout from falling fast enough. It would take particles, and it took quite a few operations to shovel it out. We decided we had to have a pressure on the top of the stuff to [fol. 158] push it down, then we made Fig. 5.

In this machine this stuff is mixed first and poured. What I was getting at, in this valve we found the top of the valve stopped up.

Q. 22. Please refer to the letters now.

A. Valve D.

By Mr. Morgan:

Q. 23. In Fig. 3?

A. Also valve D in Fig. 4, and then we decided to put a gate or door in the top of the tank. We had a new tank made and shelves rolled by the Superior Boiler Works on Mandell, just west of Cortlandt, and we took it to the

shop and punched it and riveted it and made it into a tank.

By Mr. Johnson:

Q. 24. You will have to be more specific, Mr. Fanning.

A. In what way?

Q. 25. I want you to take first your machine shown by Fig. 3 and state just exactly how you operated it, and what were the materials that you used, the pressure you used, and how you shot the grout or whatever you used. Please refer to the different letters as you go along.

A. All right.

Q. 26. And the dates.

A. I do not want to give the exact date; it was the latter part of 1901.

Q. 27. That you built the machine shown by Fig. 3?

A. Yes.

Q. 28. All right. Start from that.

A. Then we mixed grout separate in a box and poured it through this valve into the tank.

[fol. 159] Q. 29. What valve?

A. Valve B into Tank A. Then we opened valve C and shot the grout out until no more would come. Then on examination we found that most of it stayed up in the tank. It would not come out, and we decided that was on account of the shape of the part No. 20.

Q. 30. What did you shoot it out with?

A. Air; compressed air.

Q. 31. Under what pressure?

A. We had about seventy pounds or eighty pounds pressure; sometimes it varied. We had a pressure on the one which was only the reaction the concrete would give to it. The air expanded as you opened the valve because there is no pressure ahead of it. What the exact pressure was, I could not tell because we never put a *guage* on.

Q. 32. You say you blew your grout?

A. Yes.

Q. 33. In this first machine, Fig. 3?

A. Yes, sir.

Q. 34. What do you mean by grout?

A. A mixture of sand, cement and water.

Q. 35. About the consistency of what?

A. Well, so as to pour out of a bucket.

Q. 36. Thick cream, or something like that?

A. A little heavier than that, possibly very thick cream, like tar.

Q. 37. What was the diameter of the pipe that you have marked No. 21 on Fig. 3?

A. On the original machine that was a four inch pipe.

Q. 38. What was the diameter of the discharge pipe on Fig. 2?

A. That was a two inch pipe on the original.

Q. 39. How far did you shoot this grout in this first machine?

A. About twenty feet. We were trying to line, that is to get the grout back of the lining of a tunnel. The air was [fol. 160] getting out; the tunnel was constructed under compressed air, and we would find leaks, so Mr. Jackson decided that if he could get some grout back of that concrete it would plug those leaks up, so we made the machine for that purpose. We would go where we discovered a leak and drill a hole and insert a pipe, and connect this machine, put the air pressure on, and shoot the grout in there until it would not go any further.

Q. 40. Then, as I understand you, the tunnel was the first lined with concrete, and you used this machine shown in Fig. 3 to shoot grout back of previously set concrete; is that right?

A. That is exactly right.

Q. 41. What was the next step in the evolution of the pneumatic conveying of concrete as shown by these different figures?

A. The tank——

Mr. Cox: I think Mr. Johnson should not use the word "concrete." The witness is talking about grout, something essentially different.

Mr. Johnson: I am willing to say grout.

A. (Continuing:) The machine was not satisfactory, and we decided it was because the bottom was of wrong shape. We took the tank and reversed it.

Q. 42. As shown in Fig. 4?

A. As shown in Fig. 4, and did the same thing. While it worked better, it still was not satisfactory, and we operated exactly the same way as in Fig. 3.

Q. 43. Now, I want you to go a little more in detail.

[fol. 161] The Court: In what respects was it not satisfactory?

The Witness: The material would not all come out of the tank; most of it stayed in there.

The Court: All right.

Q. 44. Mr. Fanning, I want you to give a little more in detail how you operated it. What was the size of this opening, No. 23?

A. Four inches.

Q. 45. On Fig. 4?

A. Four inches.

Q. 46. What was the size of the discharge pipe, No. 24?

A. Two inch discharge pipe.

Q. 47. What was the size of the air pipe, No. 25?

A. One inch.

Q. 48. What air pressure did you use?

A. About sixty, between sixty and eighty pounds at all times.

Q. 49. And when did you use this machine, Fig. 4?

A. That was about the first of 1900, or the latter part of 1901.

Q. 50. Where did you use it?

A. In the Illinois tunnel, City of Chicago.

Q. 51. When?

A. In 1902; I would say the first part of 1902.

Q. 52. The first part of 1902?

A. Yes.

Q. 53. What does Fig. 5 on Exhibit I represent?

A. Fig. 4 was not quite satisfactory. While we could put grout in, still it was slow and we were bothered with the plugging up, and very often it would shoot right through. By the time you got so that you could work the stuff, it would be set in there, so that we had to shape it out. Then we thought of another plan, that is, putting pressure on top. So then we designed or added, rather, Fig. 5.

[fol. 162] Q. 54. You designed Fig. No. 5?

A. Yes, sir.

Q. 55. When?

A. In 1902, the latter part of 1902 or the first of 1903, I would not want to say just exactly when; not later than 1903 and not before 1902.

Q. 56. Will you describe in detail exactly this construction of Fig. No. 5, using the reference letters on the sketch or figure and adding any others that you see fit?

A. Tank A was made with a cone shaped bottom——

Q. 57. No. 26?

A. Yes, sir, and had a door cut in the top.

Q. 58. That is, door B?

A. Door B put in the top. Airpipe 27 was connected to the air pipe that lead from the main air line which was controlled by valve C in pipe 27. We also had a pipe leading from the end of the main line 28 into T-29, which connected to the cone part of the tank and also to the delivery pipe H. We then would mix the grout in the same manner as stated on the other one, pour it in the tank, fasten down the top B, open valve C, and immediately thereafter valve E, until the contents were discharged.

Q. 59. Do I understand that you had pressure above the mass of grout in the chamber A and then also you used pressure down through the nozzle or fitting 29, so as to blow the grout out of the discharge pipe H?

A. Yes, sir.

Q. 60. When did you first blow grout with this machine shown in Fig. 5?

A. About the latter part of 1902 or the first of 1903; I would not want to say positively, but in there some where.

Q. 61. Where?

A. In the Illinois Tunnel, City of Chicago, in what we [fol. 163] call the Powers-O'Brien shaft. In other words, we took the material for that shaft in under Powers and O'Brien's basement. They had a place on Madison Street. We took it through the basement down into the shaft and tunnel. We used the basement for mixing.

Q. 62. Have you any way of fixing the time?

A. The only way I can fix the time is at that time we were engaged in the structure of the 18th Street Bridge, and that is during the time of the construction of that bridge.

Q. 63. You have testified, as I understand you, that this structure of Fig. 5 was used for placing grout in the Illinois Tunnel?

A. Yes, sir.

Q. 64. Was it ever used for any other purpose?

A. Yes, sir. We found a great deal of trouble occurring in the key of the arch. It was the hardest place for us to place concrete in the entire section. We found that the hardest part of placing the concrete was in the key or the top of the arch. The tunnel was horseshoe placed, and we got talking one day and I said, "I don't see why the addition of a few stones would stop that stuff from coming in. I believe if we push that concrete into the key under pressure that we would stop a lot of that trouble."

We tried it out and did it, placed the concrete there, but it did not stop the leak any better than the grout we were using. But we mixed it up with an addition of three-quarter inch gravel, mixture 1-2-4, and shot it in at the top of the form into place after the walls had been run up to the key, what we called the key.

Q. 65. After you added the gravel that you referred to, what was the mixture then?

[fol. 164] A. Concrete.

Q. 66. At first you used this structure as shown in Fig. 5 for grouting——

A. Originally designed for grouting.

Q. 67. And you used it for grouting?

A. Yes, sir.

Q. 68. Then later you used this same identical machine of Fig. 5 with concrete to put in the key or the arch of the tunnel?

A. Yes, sir, we did.

Q. 69. When did you do that?

A. We did that the later part of 1902 or the first of 1903, about the same time along there through that term of work.

Q. 70. You gave a certain mixure there a minute ago by numbers. What did you mean by that?

A. For portions.

Q. 71. Please give it.

A. I say 1-2-4. I mean 1 is the proportion of cement, 2 the proportion of sand and 4 the proportion of gravel.

Q. 72. How big was the gravel that you used to make this wet cement?

A. What is known as three-quarter inch.

Q. 73. Was this machine ever used in placing concrete pneumatically other than placing the arch in the tunnel?

A. It was used at 177 and 179 East Monroe Street, old numbers, City of Chicago, in the basement for putting concrete in the underpinning and the floor.

Q. 74. Has that machine of yours, Fig. 5, any resemblance to the Fig. No. 2 of Defendants' Exhibit E?

A. Practically the same thing.

Q. 75. They are both meant to represent the same machine?

A. Yes, sir, I would say so; supposed to represent it in [fol. 165] the same manner; the operation in the same manner.

By the Court:

Q. 76. Mr. Fanning, have you got any drawings made at the time of this machine?

A. There were no drawings made, Judge, only pencil sketches by me.

Q. 77. Have you got them?

A. No, I have not. That was 25 years ago. Mr. Jackson may possibly have drawings made, but in 1917, I think it was, he was in the building—Mr. Jackson had the misfortune of going into bankruptcy, and he rented a little shop there and tried to start to build some stuff, and he did not have money enough, and they seized everything he had, all his plans and cuts and pictures. He had a lot of pictures and stuff. That all disappeared.

Q. 78. You have not continued the same concern in any way? You did not buy it out?

A. No.

Q. 79. You have nothing to do with that old Jackson concern?

A. I was with him until he failed. I sold out in 1906 and Mr. Jackson organized what is known as George W. Jackson, Incorporated, and the latter part of 1906 he asked me to come back with him. He asked me if I would undertake to supervise some cribbing work, which I did. I stayed with him up until the time he could not go along any longer.

Q. 80. Then what did you do after that? Did you continue the contracting business or the engineering business?

A. The engineering and contracting business.

[fol. 166] Q. 81. You have your own concern now?

A. No, I am with the Central Dredging Company.

Q. 82. That is in Chicago, is it not?

A. That is in Chicago. They are a Cleveland concern, but they have got offices in Chicago. We are doing a lot of work there.

By Mr. Johnson:

Q. 83. Do I understand from your testimony that you personally gave instructions for the building of this machine in Fig. 5?

A. I personally gave instructions for the building of that machine. We had our own shops on Mendell Street, and I personally gave the instruction for the building of the machine. The tank was built and the other parts, of course, was stock stuff, was bought and delivered to the tunnel and assembled there.

Q. 84. Have you testified what other use was made of this structure, Fig. 5, other than putting the arch in?

A. Yes, the floor.

Q. 85. When was that?

A. That was the first of 1903, I would say.

Q. 86. Is that the same job that Mr. Artingstall just testified to?

A. It must be, because there was no other that I know of.

Q. 87. That testimony as I remember it, was for a floor, and the Judge asked why it could not be done by hand with funnels to direct the flow of concrete?

A. It could.

Q. 88. Why wasn't it?

A. Mr. Jackson was using a peculiar type of mixer at the time. It was an oblong box with spiral arms on a shaft that revolved, and they were very heavy and clumsy to remove. [fol. 167] This being a small amount of concrete to put in, it did not pay to rig up anything fancy, and he had the machine and thought he would like to try it.

Q. 89. On this concreting job in 1903 at 177 Monroe Street——

A. 177-179 East Monroe Street, old numbers. The numbers have been changed since then.

Q. 90. What mixture did you use in this structure?

A. I believe 1-2-4.

Q. 91. What did you mean by that?

A. One portion of cement, two portions of sand, and four portions of gravel.

Q. 91. And the mixture then was——

A. Concrete, what is known as concrete.

Q. 92. Wet concrete?

A. Yes, sir. Water was added to the consistency that it was thought best to use.

Q. 93. How far did you blow it on that job?

A. I would say seventy feet.

Q. 94. Could you have blown it any further?

A. From what I have learned since, we could have blown it considerably further. At the time we did not know how far we could blow it. We had never tested it out. We did not know just what it would do. From what I have learned since, I think we could have carried it a thousand feet. I have seen it carried a thousand feet.

Q. 95. When was the last time that you saw this structure that you testified to in Fig. 5?

A. The last time was on Madison Street in front of what is known as a disposal station. Mr. Jackson has a disposal station which he took in excavation and also brought the [fol. 168] excavation from the tunnel through to get a shaft. In constructing that shaft, he had a great deal of difficulty with leaks. I was not on that job. I was at South Chicago on the crib, but I understood—I asked him why the machine was around there, and he said they had used it to try to plug the leaks in the shaft. But the machine was on Madison Street——

Mr. Cox: We would have to object to what Mr. Jackson told him as hearsay.

The Court: Yes.

Q. 96. As a practical contractor familiar with concrete construction, what have you to say as to the relative cost of placing concrete pneumatically by such a machine as Fig. 5 or by buggies?

A. We had decided, and so far as my experience has been, that the operation of chutes or buggies, depending on the location, is cheaper than the air system.

Q. 97. Why?

A. The initial plant is expensive on the air system. I have not had any great experience in placing by air, but I have never seen it used on any place to any great extent. I know there are millions of dollars of jobs going every day

that do not use the air system on them. They use either the buggies or the tower system.

Q. 98. In your practical experience, you think that is cheaper than this air conveyor of Fig. 5?

A. Yes, sir; we found it so in putting the concrete in the keys.

Q. 99. That is, after you had this machine of Fig. 5, you found it was cheaper to use the buggy?

A. We used little cars run on tracks.

Q. 100. Do you not call those buggies?

[fol. 169] A. We call those concrete cars. The sides came off so that the concrete would fall off them, men would take shovels and throw it off. We found it cheaper and a better job than we got by blowing it.

Q. 101. Of course, you use the cheaper method, I suppose?

A. It would be cheaper for us, anyway, because we had a number of shafts operating and we would have to put in such a large number of plants that it would run into considerable money.

Q. 102. How much?

A. $30,000 or $40,000. All our compression plants were low pressure plants. We carried only eight to twelve pounds pressure on our tunnel work.

Q. 103. What pressure did you use?

A. We had one small high pressure outfit there, and we connected that up to it. That ran about sixty or seventy pounds. We always put in a small high pressure for running a drill or something of that kind.

Q. 104. So you had two systems of pressure in the tunnel, one low pressure and one high pressure?

A. Yes, sir.

Q. 105. And when you used this structure of Fig. 5, you connected it up with the high pressure?

A. Yes, sir.

Q. 106. That was about what pressure?

A. From sixty to eighty pounds. I would say it averaged seventy pounds at all times. If we were drilling, it would probably run it a little higher; probably eighty or ninety pounds.

(Adjourned to October 6th, 1926; 10:30 A. M.)

[fol. 170] JOHN T. FANNING resumed:

Direct examination.

By Mr. Johnson (continued):

Q. 107. Mr. Fanning, you have mentioned in your affidavit several times George W. Jackson. Is he alive now or not?

A. George W. Jackson is dead.

Q. 108. When did he die?

A. I think it was three or four years the 5th of last February.

Q. 109. In answer to Q. 9 yesterday you stated, referring to the Ford job that you were there during the time. Were you employed on this Ford job laying concrete or were you employed on other work there during that time and saw the concrete work being done?

A. I was employed on other work.

Q. 110. In the operation of this pneumatic concrete laying machine that you built, figure 5 of Exhibit I, and that you used in 1903 to lay a concrete floor at No. 177 East Monroe Street, was the concrete wet or dry concrete?

A. A wet mixture.

Q. 111. You mean by that wet concrete?

A. Wet concrete, yes.

Q. 112. Did the concrete come out of exit pipe H of figure 5 in slugs or as a mass?

A. As a mass.

Q. 113. Is this pneumatic concrete machine shown by your sketch, figure 5 of Exhibit I, as to which you have testified, the same machine that you heard Mr. Artingstall testify to as to his own sketch, figure 2 of Exhibit E?

A. It is the same machine.

[fol. 171] Cross-examination.

By Mr. Cox:

X Q. 114. You were present during the examination of Mr. William Artingstall as a witness in this case?

A. I was.

X Q. 115. During the period that you have mentioned when you say these machines were used, what was your connection with Mr. Jackson?

A. I was mechanical engineer for Mr. Jackson.

X Q. 116. Were you connected with the Jackson-Cordett Bridge Works?

A. I was vice president and general manager of the Jackson-Cordett Bridge Works.

X Q. 117. And what was their business?

A. Contracting, bridge building, form building, concrete forms, steel work of any description and contracts.

X Q. 118. They had a factory outside of Chicago, did they not?

A. At 80 Mendell Street I believe was the address. Not outside of Chicago; inside of Chicago.

X Q. 119. How far from 177 East Monroe Street?

A. About four miles.

X Q. 120. What did you have to do with the work in that job?

A. I had general supervision of all work in the shop and out of it.

X Q. 121. And Mr. Jackson at that time was employed by the Tunnel Company to supervise the construction of their tunnels on a salary, was he not?

A. Just what his arrangements with the Tunnel Company were, I can not tell you. I know he was general manager and chief engineer of the Tunnel Company.

X Q. 122. You were not employed by the Tunnel Com-
[fol. 172] pany?

A. No, sir, by Mr. Jackson personally.

X Q. 123. Your work was looking after the shop which you have mentioned?

A. My work was looking after the shop or any other work which Mr. Jackson gave me.

X Q. 124. That was taken by the Jackson & Cordett?

A. That was taken by the works. I had two salaries, one from Mr. Jackson and one from the Jackson-Cordett Bridge & Steel Works.

X Q. 125. Do you remember whether you visited the tunnel in 1900 and 1901?

A. 1901, yes.

X Q. 126. How about 1900?

A. No.

X Q. 127. What was going on in the tunnel in 1901?

A. They were working on what was known as shaft No. 1, back of Powers & O'Brien's place of business. The shaft was in the alley. Operations were light at that time.

X Q. 128. Where did you say that these three machines that you have testified about were made?

A. Made?

X Q. 129. Yes.

A. Well, the first two machines, I built the tanks and fittings, and we fitted them up, and the valves and all work on them was done in the shop on Mendell Street.

X Q. 130. In the Jackson & Cordett shop?

A. The first tanks were made,—no, in the shop I had on Superior and Morgan. The shop I was interested with my brother in.

X Q. 131. Yes?

A. The last tank was made in the shop on Mendell Street.

X Q. 132. The last two?

A. How is that?

X Q. 133. The last two tanks?

A. The last two.

X Q. 134. Were any of those made at the Jackson & Cordett shop?

A. The last tank was made at the Jackson & Cordett [fol. 173] shop, and the shell was rolled by the Superior Boiler Works.

X Q. 135. And the tank was made up in the shop?

A. The tank was made up in the shop.

X Q. 136. That is the one represented by figure 5?

A. Yes, sir.

X Q. 137. In Exhibit 1?

A. Yes, sir.

X Q. 138. And was that same tank that you said you saw for the last time at the disposal place?

A. At the disposal station on Madison Street.

X Q. 139. I believe there was a machine made as a No. 4, as shown in Exhibit 1, before No. 5, is that correct?

A. There was a modification of No. 4, and it was such a foolish modification that I am ashamed to tell about it.

X Q. 140. Well, I do not want to embarrass you.

A. I will tell you, if you want to know.

X Q. 141. What was it?

A. We put a plate at the top of it thinking by putting the air on top of the plate we could press the concrete out faster or better, but we found in the vernacular it was a lot of apple sauce.

X Q. 142. You do not know what has become of any of these machines or whether any of them are in existence?

A. No, I could not tell you a thing about it. The Tunnel Company might know. They had everything, I think.

X Q. 143. These machines that were made up, were they billed to the Tunnel Company, or did they remain the property of Mr. Jackson or of Jackson & Cordett?

A. That I can not tell you. I bought them under Mr. Jackson's direction, and delivered them where he told me, and whether he claimed them or anything else, I know noth- [fol. 174] ing about it. I presume they belonged to the Tunnel Company.

X Q. 144. You stated that the last time you saw the machine of figure 5 you were working on some other job. What was that job?

A. At 68th Street Crib, the waterworks crib in the lake. That is, I was at South Chicago constructing it for Mr. Jackson.

X Q. 145. Can you fix the date of that?

A. Well, not exact. I would say it was June or July of 1906, along in there.

X Q. 146. You can not fix the date, though?

A. The exact date I saw the machine?

X Q. 147. Yes. How long were you working in that crib?

A. I was there all of that summer.

X Q. 148. Just that summer?

A. Just that summer, yes, sir.

X Q. 149. You worked on the crib?

A. Just that summer, yes, sir.

X Q. 150. Your work on the crib did not have anything to do with Mr. Jackson's work on this disposal place?

A. No, that was a separate contract for a water tunnel for the City of Chicago.

X Q. 151. Do you remember the details of the construction of that Chicago tunnel commonly called "The Illinois Tunnels"?

A. Yes, sir.

X Q. 152. What was the size of the tunnel?

A. The inside of the concrete was six feet by four inches by seven feet, eight inches. The outside was two feet larger each way. It was horseshoe-shaped.

I may be wrong; it may be six feet eight by seven feet four, but those are the approximate dimensions; and they changed at the intersections where they went around the [fol. 175] curve they were widened out some. I am talking about the tunnel proper.

Q. 153. And the work on those tunnels was done under air lock, was it not?

A. Yes, sir.

X Q. 154. That is to say, there was a bulkhead, and the men working on the excavations worked inside of the bulkhead and in advance of it?

A. Yes, sir.

X Q. 155. And the air pressure in that lock was what, would you say?

A. From eight to twelve pounds, depending on conditions.

X Q. 156. When you operated this machine, how did you get the high pressure air through the bulkhead?

A. I had a high pressure compressor in the basement of Powers & O'Brien's.

X Q. 157. How did you run that through the bulkhead?

A. That was done through a pipe, through the air line.

X Q. 158. How did the pipe go through the air line?

A. The usual method with flanges screwed in on one side and out the other.

X Q. 159. They bored a hole through the bulkhead?

A. They bored a hole through the bulkhead and riveted flanges on it, and screwed a pipe on it and screwed on the other side with valves on each side.

X Q. 160. Was this work done preparatory to using the pneumatic machine?

A. No, they had that all the time.

X Q. 161. They had all these air locks and high pressure air pipes?

A. No, they had on this one, that was shaft No. 1. They afterwards built individual compressor plants to run inside the locks to save the big compressor.

X Q. 162. Now, that building at 177 East Monroe Street, [fol. 176] that building was rented or owned by the Tunnel Company, was it not?

A. They leased it, I believe. Just what their arrangements were, I am not positive. Those details I am not positive about.

X Q. 163. They occupied it?

A. They occupied it, yes, sir.

X Q. 164. Mr. Jackson's occupancy of part of that was as an engineer and general superintendent?

A. Yes, sir.

X Q. 165. I believe you are unable to state whether Mr. Jackson had any drawings made of this machine at the time?

A. I am unable to state that positively. He had none made in my office, I know.

X Q. 166. Well, Mr. Jackson had a great many ideas, didn't he?

A. Yes, he had a number of them.

X Q. 167. He was a man who invented a great many things?

A. Quite a few.

X Q. 168. And patented quite a few?

A. He took out quite a number of patents, I believe.

X Q. 169. Now, I want to clear up this point. How long were you with Mr. Jackson? That is to say, when did you first separate from him in business?

A. The first separation was in 1906.

X Q. 170. Yes, and the next?

A. I went back with him again in 1906 to take care of the crib work for him.

X Q. 171. Yes, and how long were you with him then?

A. I think about six months.

X Q. 172. Now, I believe you said that it was hard to place the key of the tunnel lining by hand?

A. Why, it was the most difficult part of the concreting, that is what I meant, because it is in a confined place, and [fol. 177] they have to throw it up over their heads, and throw it in back.

You understand, as they concrete the sides they leave the lagging plates off until they fill the concrete to the top of the lagging plates in place, and then keep adding lagging

plates as they go up until they come to a confined place called the key. That of course is a little more difficult, and they have only about twelve inches to place that in.

X Q. 173. That might be called the keystone of the arch?

A. That might be called the keystone of the arch, yes.

X Q. 174. And the floor and sides of the tunnel and the roof up to this key were all placed by hand?

A. At first, yes.

X Q. 175. And was the concrete rammed in?

A. Yes, sir.

X Q. 176. How was the concrete placed by hand in the key?

A. Shoveled in.

X Q. 177. Shoveled in, and then rammed?

A. Tamped, what we call tamping.

X Q. 178. And it is your testimony that you used this machine No. 5 of Exhibit I to place the key in that arch?

A. We did.

X Q. 179. Well now, how much of that key did you place with that machine?

A. I am not positive on that point, 100 feet possibly or more.

X Q. 180. 100 feet or more?

A. Yes.

X Q. 181. And there were about 60 miles of those tunnels in the streets of Chicago?

A. I think there are about 100.

X Q. 182. They were building the tunnel lining then at a pretty rapid rate, were they not?

A. Yes, sir.

[fol. 178] X Q. 183. In 1903 and thereabouts?

A. Yes, sir.

X Q. 184. Now, was that 100 feet of key that you placed with this machine all in one piece or strips or different places?

A. All one strip, I believe. I was not there all the time they were using it, you understand. I had other duties to perform. I got up the idea of the machine or with Mr. Jackson's collaboration, and when the machine would get started, I was through, and I had other things to go after.

X Q. 185. Was it placed all at one time or at different times?

A. I believe all at one time. I do not want to be positive on that? I know they used it for over a week, and at that time they were driving about 15 feet in a day in a heading, and it was in one heading only.

X Q. 186. Do you remember about where that was?

A. On LaSalle Street north of Madison.

X Q. 187. North of Madison and between what streets?

A. I do not want to be sure of that. We would go in there and I do not know just what streets we were under or how far we were in. These details I did not bother with.

X Q. 188. Might it have been three or four blocks north of Madison?

A. I do not think it was that far. I would not say how far. I walked in that tunnel there myself and did not know where I was at times. There were no markings in the tunnel.

X Q. 189. Have you ever personally done any concrete tunnel lining?

A. Yes, sir.

X Q. 190. With a pneumatic machine?

A. No, sir.

X Q. 191. Never used a pneumatic machine for tunnel lining?

A. I never did, no, sir.

[fol. 179] X Q. 192. Do you know how extensively these pneumatic concrete placing machines are used today for tunnel lining?

A. At the present time I do not know. I know they have not been used on a great many tunnels.

X Q. 193. And I believe it is your testimony that after using this machine, illustrated by figure 5 of Exhibit I, on this one strip or piece of key you discontinued using it?

A. I do not know. No, they used it for grouting right along. I would be positive almost of that that they used it for grouting whenever they would have a leak for quite a while afterwards, but I did not go into that part of it.

X Q. 194. They did not use it any more for placing concrete?

A. No. After 177 Monroe Street? That was after the tunnel was placed.

X Q. 195. Yes.

A. If they did, I do not know; they may have.

X Q. 196. How soon after this tunnel was the work at 177 East Monroe Street?

A. Four or five months, I believe.

X Q. 197. How did they get the machine into 177 East Monroe Street from the tunnel?

A. I do not know. I did not bring it up.

Mr. Jackson had the foundation to bring it up there, and I do not know how he brought it. I presume he brought it up out of the shaft and transported it over there.

X Q. 198. Were you at 177 East Monroe Street when this machine was placed there?

A. I was there when they set it up and started it.

X Q. 199. What was the condition of the basement there?

A. The basement was practically clear at that time.

[fol. 180] X Q. 200. Was the shaft finished?

A. No, the shaft was not finished.

X Q. 201. How far along had they gotten with that?

A. That I do not know. I would not say just when that shaft was finished or when it was not. These details were not in my line of business.

X Q. 202. You were not connected with the tunnel?

A. I was not connected with the tunnel company, excepting as advisory engineer to Mr. Jackson on methods that he wanted to use. He asked my opinion on almost all mechanical devices that he used. I do not mean to say that he used all the things I suggested, or stopped using some of the things I suggested that he not use.

X Q. 203. That tunnel work, by the way, the tunneling of the streets of Chicago continued until 1909, did it not?

A. I understand later than that even. They did some work themselves. Mr. Jackson, I believe, continued until about 1909.

X Q. 204. Do you know how long Mr. Jackson continued there as engineer?

A. I am not positive on that score. I can give you my opinion of it.

X Q. 205. Yes.

A. I think in 1906 that Mr. Jackson made different arrangements. I think his contract was up, and he made different arrangements with the Tunnel Company. I think he went down afterwards on a percentage basis, but that I do not know. I was not a partner of Jackson at that time. I was simply an employee.

X Q. 206. At any rate, he continued his work on the tunnel until about 1909, according to your recollection?

[fol. 181] A. Up to that time sometime, yes, sir.

A. Up to that time sometime, yes, sir.

X Q. 207. Now, do you remember how that machine that you have described as being used at 177 East Monroe Street was mounted?

A. Mounted on a wooden frame.

X Q. 208. About how high was the frame?

A. Well, I do not know the height of the frame. The top of the machine I should judge would be about six feet.

X Q. 209. About how big was the machine?

A. The tank was rolled 20 by 30.

X Q. 210. Twenty by thirty?

A. Inches. I am talking about the sheet.

X Q. 211. Now, you are talking about the machine, figure 5 in Exhibit I?

A. Yes.

X Q. 212. By the way, did Mr. Jackson to your knowledge use any other grouting machines there than the ones you have testified to?

A. Afterwards I think he had another machine. In fact, I know he had one other.

X Q. 213. Where did he get that?

A. He bought it. It was not a pneumatic machine.

X Q. 214. I mean pneumatic machine.

A. No, not to my knowledge.

X Q. 215. He did not have any other pneumatic machines than the one you mentioned, to your knowledge?

A. Not that I know of.

X Q. 216. Now, I would like to have you make us a sketch showing how that machine was used to place the key of the arch. I will give you a piece of paper. Just draw a lengthwise section of the tunnel and show us the key and how the thing was done.

A. I think I can show that better by a cross section.

[fol. 182] X Q. 217. All right. Please show it both ways.

A. (Witness does as requested.) That will give you roughly about the way that was done.

X Q. 218. All right, now I want you to make——

A. This would show you where we placed the pipe. The machine would be here (indicating) and the pipe would come up there (indicating). It was on a track.

X Q. 219. Now, I will ask you to indicate the tunnel wall in the roof by "A".

A. (Witness does as requested.) At the roof?

X Q. 220. Yes, at the roof, put the "A" at the roof and also on the lengthwise or longitudinal view up above there.

A. That would be shaded. That comes on a curve and will be shaded down.

X Q. 221. Now, please indicate the forms running up to the key by "B" in both views.

A. (Witness does as requested.)

X Q. 222. Now, please indicate the pipe leading to the key for supplying the material from the machine by "C" in both views.

A. (Witness does as requested.)

X Q. 223. And the machine, please make that "D."

A. (Witness does as requested.)

X Q. 224. Now, the el running out to the machine; I mean the air pipe running through the lock to the machine?

A. The compressor air pipe that came along down on the floor?

X Q. 225. Just indicate it on both views, please.

A. Coming to the heading this way it was not inside the extension. We had to put an extension on the heading. That is where the heading was not concreted.

X Q. 226. Just show how that pipe ran to the machine?

A. From the air lock. This direction is the air lock and [fol. 183] the pipe ran through the heading. I have this reversed. This machine should show in here (indicating).

X Q. 227. Can not you show it?

A. The final position of the machine would be back there (indicating).

X Q. 228. Then your drawing is incorrect?

A. What we did instead of extending the pipe, when we would concrete a little we would run the machine back a little. The machine was mounted on a car.

X Q. 229. I want you to indicate how you connected that compressor air pipe that ran through the air lock to the machine.

A. I think it was connected to the machine. That was connected to the machine with a flexible joint down here, and run to the tank or to the pipe from the tank. I will show that right now, running from this side of the tunnel on the bottom, it ran across to the tank to the lining, and hooked onto that lining with a *t*.

X Q. 230. Just please letter that now "E" on both views.

A. (Witness does as requested.) It is pretty hard to show it. You are looking right at it. There will be a ring there and an "E". You are looking at the end of the pipe on the side when you turn over to your tank.

I do not know whether you can make that out or not. I can make you a sketch of that so you will have it tomorrow in pretty good shape, so you will understand it. I am not a very good free hand drawer.

X Q. 231. In this upper figure the pipe from the el out to the machine is running to the left, is that right?

[fol. 184] A. As you walk to the heading it was on the left hand side.

X Q. 232. No, I mean it would be this pipe running to the left or from the left in the upper figure of your sketch?

A. That was along the longitudinal side of the tunnel.

X Q. 233. Just please put an "E" on the end of that pipe nearest the air lock.

A. (Witness does as requested.)

Mr. Cox: All right. I offer that sketch in evidence.

(Marked Plaintiff's Exhibit No. 11.)

X Q. 234. Do you know how long this machine that you testified about was used at 177 East Monroe Street?

A. When they started it we had had an accident on the Eighteenth Street Bridge, and I was called away and went down there. I came back in about five days and everything was completed, the floor was completed. How long they used it, I do not know.

X Q. 235. Did you see it used for anything except placing a part of the floor there?

A. And underpinning.

X Q. 236. And some underpinning?

A. Yes, sir.

X Q. 237. That was about how long?

A. Well, the whole length of the wall. They wanted the foundation a little deeper; they had an old foundation, what they call a flooring foundation, and Mr. Jackson intended to put some machines in there, and wanted to get down to solid ground, so he had to underpin the wall to below the basement.

X. Q. 238. And the concrete flooring, was that the whole [fol. 185] floor or just a section of the floor?

A. The whole floor. He put in an entire concrete floor in the basement.

X Q. 239. How much of the floor was done when you saw it?

A. They just started it.

X Q. 240. Can you tell us what part of the year 1903 this was?

A. It must have been the first part of it; I am not positive.

X Q. 241. You say it was the first part?

A. That is my recollection. The reason I say that is I went with Mr. Jackson and did certain work for him previous to 1901. Jackson had another job, but I went with him in 1901, and he got me to sell out my interest and go with him in 1901. That is about the time we were doing the Eighteenth Street Bridge, which was about the beginning of 1903. We started to wreck the Eighteenth Street Bridge. We had fabricated it previous to that time.

X Q. 242. You say you remember it was in the early part of 1903 because you had an accident about that time?

A. Yes.

X Q. 243. You connect that accident with it?

A. I do, yes; that is what brings it to my mind.

X Q. 244. Was that a serious accident?

A. A derrick fell down, that was all.

X Q. 245. Hurt anybody?

A. A man claimed to be hurt, but we finally found he was not.

X Q. 246. As I understand it, from that time in 1903 until later which you say was 1906, when you saw it at the disposal plant, you did not see this machine?

A. I had seen the machine in the tunnel after that, yes, but I did not see it used.

X Q. 247. Where was it in the tunnel when you saw it? [fol. 186] A. It was, I think, down near the Van Buren Street incline.

X Q. 248. In part of the tunnel?

A. They had some trouble there with leaks, going under the river on Van Buren Street that went down about 65 feet.

X Q. 249. When was that?

A. In the year 1905.

X Q. 250. And that time was the machine hooked up?

A. No.

X Q. 251. To be operated?

A. No, it was not. They took it up there, and they were getting it ready. They had some serious leaks of air there, and they were getting ready to try to plug them up.

X Q. 252. Was this machine mounted permanently on a track?

A. It was mounted on a little car, and it could be taken off and set on, bolted to the frame of the car.

X Q. 253. But in the basement at 177 East Monroe Street I understand that it was mounted on a frame.

A. They took the frame right off the car, and brought it up and set it on some timbers.

X Q. 254. At the time that you saw Mr. Jackson use the machine at 177 East Monroe Street, did he have his headquarters there in the basement?

A. On 177, not yet, but he was going to go there. They were remodeling the building to get ready to go to 177 and the building had not been occupied. They just leased it, when this work was done.

Redirect examination.

By Mr. Johnson:

R D Q. 255. You testified in your cross examination that so far as you knew this machine, figure 5, Exhibit I, was [fol. 187] only used in the tunnel for about 100 feet or so placing the key. Why was it not used for any greater distance?

A. Mr. Jackson decided that he could put it in by hand just as well and cheaper than bother with the machine.

R. D. Q. 256. So that that is the reason that it was not used beyond the 100 feet or so?

A. That is the reason, yes, sir.

R. D. Q. 257. This drawing that you have made is not very clear to me, Mr. Fanning. Do I understand that there was a form up here by the key arch or not?

A. No form. We placed the lagging. You see the ribs are set up, and, as I said, as we built up the concrete the lagging plates were placed.

R. D. Q. 258. What are lagging plates? Is it a form?

A. It is a form, yes.

R. D. Q. 259. That is what I want to know.

A. It is a piece of a form.

R. D. Q. 260. The key arch would have a form?

A. Yes, sir; certainly.

R. D. Q. 261. Will you indicate that on this sketch?

A. Well, I showed it there with the form out, but this shows the ribbing.

R. D. Q. 262. Put the form in them.

A. Before we would close that we would put the form in there.

R. D. Q. 263. I want the form.

A. But those plates were placed as we concreted.

R. D. Q. 264. Put the form there, please, and give it a number or letter.

A. F.

R. D. Q. 265. You have now indicated the key arch as having a form, the form being "F," is that right?

A. Yes, sir.

[fol. 188] R. D. Q. 266. It was brought out in your cross examination that after starting to use this machine No. 5, Exhibit I, for laying the concrete floor at 177 East Monroe Street—

A. That was the old number.

R. D. Q. 267. You saw a portion of the floor laid by this machine, and then you were called away on account of an accident?

A. Yes, sir.

R. D. Q. 268. Is that right?

A. Yes.

R. D. Q. 269. You were away five days or so?

A. Five days before I went back there.

R. D. Q. 270. When you went back the floor was completed, was it not?

A. The floor was completed, and the machine disconnected.

(It was stipulated that the rebuttal evidence be taken at this time.)

REBUTTAL PROOFS

WILLIAM H. LARKIN, JR., called as a witness on behalf of the plaintiff, in rebuttal, having been duly sworn, testified as follows:

Direct examination.

By Mr. Cox:

Q. 1. Mr. Larkin, will you please state your name, age, residence, and occupation?

A. William H. Larkin, Jr., age 56, occupation mechanical [fol. 189] engineer United States Rubber Company; residence 285 Central Avenue, New Haven, Connecticut.

Q. 2. Have you ever been interested in concrete and the placing of concrete pneumatically?

A. Yes, sir, for twenty-five years.

Q. 3. Have you during that time kept records of the development of that branch of the industry?

A. Yes, sir, carefully.

Q. 4. I will ask you to state whether to your knowledge anything was published relating to the work of John H. McMichael prior to,—well, we will say 1915?

A. Yes, sir.

Q. 5. When was the first thing that came to your attention?

A. About 1907 with regard to his work in Toledo.

Q. 6. And what was that?

A. He did some work for the Steel Company in Toledo, placing concrete pneumatically through pipes.

Q. 7. Now, did you see any article published in a magazine or engineering publication relating to this work?

A. Yes, sir, I have a copy of the article which I cut out personally about 1907 relating to Toledo, and also of the Harvard Denison Viaduct of Cleveland.

Q. 8. And when was that article published?

A. As near as I can recollect in 1907. The date is on the article there in that scrap book of mine.

Q. 9. Now, I will ask you to fix the date by referring to this book which you say is your scrap book.

A. The article in regard to McMichael's Toledo work I cut out of "Concrete Engineering," in December, 1909.

Q. 10. And you say your recollection is that something relating to that was published in 1907?

[fol. 190] Mr. Johnson: The witness has stated that that it was 1909. I object to the question that has just been asked. He is attempting to put dates in the mind of the witness when he has already testified it was 1909.

The Court: Objection sustained.

Mr. Cox: I only did that when the witness mentioned the publication in 1907.

Q. 11. Now, this publication in 1909 that you have identified, do you understand the apparatus illustrated and described and did you understand it at the time?

A. Yes, sir.

Q. 12. Just please describe it briefly.

Mr. Morgan: I object to that question, your Honor. The article speaks for itself.

Mr. Cox: I will tell you of this. The witness Artingstall said he showed McMichael how to make his machine work by putting a piece in the bottom in 1911.

Mr. Morgan: Your Honor, we will withdraw our objection to the question if the witness will state that that is his opinion. If he is going to testify absolutely as to the structure, and the structure is illustrated and described and explains itself, and if the disclosures there are incomplete and this man as an expert wishes to express an opinion on these points, we will not object to its being put in.

Mr. Cox: That is all.

The Court: All right, go on.

[fol. 191] A. The machine consists of a tank with a conical shaped lower end. On top of the tank there is a hopper which communicates to the tank body itself. On the lower end of the tank attached to the conical part is a discharge pipe which receives the concrete. Compressed air is ad-

mitted to the top portion of the tank by a small pipe from which also leads a connection to the bottom portion of the apparatus directly into the discharge pipe. What we knew in those days as a booster.

Mr. Cox: Now, I will offer in evidence a photographic copy of that article, and submit to plaintiff's counsel the original article in the witness' diary.

Mr. Johnson: I object to that, your Honor. This article does not prove itself. Apparently they are relying upon this article, and if they are relying upon this article simply to refresh the recollection of the witness, that is one thing; but if they are relying upon it as a publication, why, that is another thing.

The Court: What do you wish them to prove, the publication?

Mr. Johnson: They should certainly have some proper way of proving that that is the publication.

Mr. Morgan: It is nothing but a cut out of a scrap book.

Mr. Cox: This witness says he cut it out.

[fol. 192] The Court: Where is the original that it was cut out of?

Mr. Cox: Right here.

Mr. Morgan: I know, but it does not establish that it was published on that date.

Mr. Cox: It has the date on it, and he says it was cut out at that time.

The Court: I will allow it. You do not want him to go to work and prove that that was actually published in that book, and so forth?

Mr. Johnson: Looking at the book here, it looks all right.

The Court: You do not suppose that he made up a magazine?

Mr. Johnson: I hope not.

Mr. Cox: I will ask the witness.

By Mr. Cox:

Q. 12. Can you state whether the magazine "Concrete Engineering" was published in December, 1909?

A. I can.

Q. 13. And you cut it out about that time?

A. Yes, sir.

The Court: All right.

(Marked Plaintiff's Exhibit No. 12.)

Q. 14. Now, at or about that time you also obtained a paper folder describing McMichael's work on the Denison Viaduct in Cleveland?

A. Yes, sir, the full name was Harvard-Denison Viaduct.

Q. 15. How did you receive that?

[fol. 193] A. This was sent to me through the mail by an associate of mine in the concrete engineering business.

Q. 16. When did you receive it?

A. I know that by the post mark on it which states "January 31, 1910."

Q. 17. Did you visit the Denison Viaduct while that work was going on?

A. No, sir, afterwards.

Q. 18. How soon afterwards?

A. Why, about, well, very shortly after it was finished, while some of the contractor's machinery was still on the job.

Mr. Cox: Now, I would like to offer this article and this illustration and description of the work on the Denison Viaduct in 1909 which the witness has testified to.

Mr. Johnson: Did you get this in 1910 or 1911?

The Witness: January, 1910.

Mr. Johnson: I see no objection to it except it is immaterial.

The Court: Overruled.

Mr. Cox: I will remove this article from the witness' diary and offer it in evidence.

(Marked Plaintiff's Exhibit No. 13.)

Cross-examination.

By Mr. Johnson:

X Q. 19. As I understood you, Mr. Larkin, this Plaintiff's Exhibit 13 you received on or about January 31, 1910?

A. Yes, sir.

X Q. 20. I will ask you to point out on the three cuts on this exhibit where the air is shown admitted to the concrete blower, if it is a concrete blower.

[fol. 194] A. This evidently is air pipe here, and the connection to the top of the tank is about here (indicating).

X Q. 21. Better letter it as you go along, if you will.

A. I should call the air pipe leading air to the machine "A" entering the machine at the point "B." I assume, if I may, that the connection to the lower end of it is concealed by the body itself. This picture is not very distinct.

X Q. 22. Then, as I understand you, Mr. Larkin, no one of these cuts of Exhibit 13 show any air connection with the alleged pneumatic blower except in the top which you have designated "B," is that right?

A. Right.

The Court: Do you mean in the top of the hopper?

Mr. Johnson: Yes, sir.

By Mr. Johnson:

X Q. 23. That is, there is only one air connection shown, if shown at all, in this Exhibit 13?

A. Due to the position of the photographer.

X Q. 24. I do not understand you, sir.

A. The pipe to the lower connection is necessarily behind the machine and the machine is between us and the back connection.

X Q. 25. I will ask you to take this same cut and put a letter on the lower air connection if you can find it.

A. The machine itself is exactly between us and the lower air connection as the photograph was taken.

X Q. 26. That may be true, Mr. Larkin, but I am talking now about the exhibit itself and not asking you to draw [fol. 195] on your imagination. I am asking you to kindly point out on this exhibit by a suitable reference letter the second air connection if you find it on that cut.

A. It is not shown.

X Q. 27. I hand you Plaintiff's Exhibit No. 12 and ask you to point out in the two cuts, A and B, how the air was admitted to the cylinder of this pneumatic blower, if that is a pneumatic blower?

A. There is a rubber hose connected with the air receiver. A. The rubber hose marked B connects to the top of the machine at the point C. A branch leads down from the point C by means of the pipe D to the lower end of the

apparatus at the point E. This (referring to the second cut, B) is simply the discharge end. It simply shows that the discharge end of the apparatus may be 100 yards away from the machine.

X Q. 28. Now I ask you if either cut of this exhibit 12 shows any air connection other than that which you have just described?

A. I think I understand ou. There are two air connections. One is at the point C at the top of the machine and one at the point E at the bottom of the machine.

X Q. 29. Do you mean to say, sir, that the air connection E, this indistinct line adjacent apparently to a pipe, is a second air connection?

A. Yes, sir.

X Q. 30. If that were an air connection it would let air in at right angles to the discharge pipe which I will ask you to mark "F," would it not?

A. It would be parallel in the same plane with the beginning of the discharge pipe and at an angle with a later por- [fol. 196] tion of the discharge pipe. The discharge pipe takes a turn slightly away from the machine.

X Q. 31. Where is the description of this connection E that you state is the second air connection? Is it in that article?

A. No.

X Q. 32. Then you are just drawing on your imagination when you say that E is a second air connection, are you not?

A. No.

X Q. 33. Why not, sir?

A. Because I was the first patentee on that style of apparatus and I followed McMichael's work from the start. I knew exactly what his machine was.

X Q. 34. That is, you knew what his patent was? Do you mean?

A. Both the patent and the published descriptions of his machines. I have a great many of them.

X Q. 35. That is, when this thing was published, say in December, 1909, you knew McMichael's commercial form of machine and also his patent?

A. Yes, sir.

X Q. 36. The patent in this suit?

A. Yes.

X Q. 37. Had you actually seen the machine of Exhibit No. 12 at this time?

A. No.

X Q. 38. When did you first see a machine like Exhibit No. 12 in operation?

A. I never saw it.

X Q. 39. Then, if I understand you correctly, there is no description in this Exhibit No. 12 about any second air connection which you happened to have lettered "E," and you have never seen the machine in operation?

A. No.

Redirect examination.

By Mr. Cox:

R. D. Q. 40. Mr. Larkin, have you seen pneumatic concrete placing machines in operation other than McMichael's?

[fol. 197] Mr. Johnson: I object to that, your Honor, on the ground that it is irrelevant.

The Court: I will allow the question. It can not do any harm.

A. Yes, sir, machines of my own design.

R. D. Q. 41. Have you operated them yourself?

A. Yes, sir.

Mr. Cox: I want to offer in evidence a certified copy of the drawings in the application of John H. McMichael for a patent filed September 6th, 1910. The patent is No. 1,185,117.

Mr. Johnson: I see no objection to it, your Honor.

(Marked Plaintiff's Exhibit No. 14.)

John Ericson, called as a witness on behalf of the plaintiff, in rebuttal, being duly sworn, testified as follows:

Direct examination.

By Mr. Cox:

Q. 1. Mr. Ericson, where do you reside?

A. Chicago, Illinois.

Q. 2. What is your occupation?

A. I am City Engineer of the City of Chicago.

Q. 3. As City Engineer of the City of Chicago how many engineers have you under you?

A. Taking all classes of engineers I must have more than a hundred, anyway; perhaps more.

[fol. 198] Q. 4. Is Mr. William Artingstall one of them?

A. Mr. Artingstall at the present time is detached from the Engineers Department for the last two or three years.

Q. 5. Has he an office in your Bureau?

A. Yes, sir.

Q. 6. Is he employed by the City?

A. Yes, sir.

Q. 7. At what salary?

A. $5,000 a year.

Q. 8. What did Mr. Artingstall have to do with the erection of the $5,000,000 Municipal Pier in Chicago?

A. I was Chairman of the Harbor & Subway Commission that was appointed in 1911 to prepare plans for a subway and also to have charge of the assignment and layout of Municipal piers, and during that time Mr. Artingstall was one of the employees of the Commission.

In 1914 I left the Commission and went back to my regular duties as City Engineer. I continued as City Engineer even during that time, but I had an assistant, a Deputy, that carried on most of the work in the City Engineer's office at that time.

While I was there, in the three years I was there, Mr. Artingstall was employed almost exclusively on the subway work, the detail work on the subways. After I left, the general plans had been made and detailed plans to some extent were made afterwards, and I do not know whether Mr. Artingstall had anything to do with the Municipal Pier after that or not.

There was a man by the name of Shanklin that had charge of the work.

Q. 9. What had you to do with the construction of the Illinois tunnels under the streets of the City of Chicago?

[fol. 199] A. The work of supervising the work for the City, to see that the ordinances were complied with and so forth, was turned over to me in 1900. I am sure it was in

1900. Since that time I had complete charge for the City as supervising engineer over that construction. There was assigned to the City Engineer other duties.

Q. 10. What is the extent of those tunnels?

A. They must be about this time about sixty miles, I believe.

Q. 11. Were you familiar in a general way with the work that went on in those tunnels between 1900 and 1907?

A. Yes, sir.

Q. 12. To whom were all the plans for work in that tunnel submitted?

A. They were submitted to me for the issuing of permits.

Q. 13. And by whom were they submitted?

A. All the plans I saw ever since I had charge of that work were signed by Alfred Slade, Engineer of the Tunnel Company.

Q. 14. By the way, you are an engineer, Mr. Erieson, are you?

A. Yes, sir.

Q. 15. Where were you educated?

A. I was graduated in 1880 from the Royal Polytechnic Institute of Stockholm, Sweden, and I have been in the City Service as civil engineer and City Enginer 42½ years, and I have been City Enginer 30 years next spring.

I might mention that as City Engineer, the City Engineer has charge principally of the construction, operation and maintenance of all the waterworks system, of all bridges, and such other work as the Commission or the Council as- [fol. 200] signs to the City Engineer, like this pier work, and so forth.

Q. 16. Did you have inspectors under you to inspect that tunnel as the work progressed?

A. Yes, sir.

Q. 17. Did you visit the tunnel personally between 1900 and 1907 at frequent intervals?

A. Yes, sir; not very frequently, but I went down there from time to time.

Q. 18. About how often?

A. Well, it may have been once a month, sometimes a longer period between.

Q. 19. Who was your chief inspector during that period?

A. Mr. Lynch was chief inspector——

Q. 20. His full name?

A. John Lynch, practically ever since the work was started, but I had an engineer representing me on the work up until 1904, and after 1904 I had one or two inspectors; I had one I remember distinctly because he stayed a long, long time, but I think I had a second one, I can not remember his name.

Q. 21. Were you familiar with the construction of those tunnels and the lining of them?

A. Yes, sir.

Q. 22. And with the work that went on there?

A. Yes, sir.

Q. 23. How were the walls of the tunnel lined?

A. The walls were lined with concrete. The tunnel itself, all I saw of it, I mean the material through which the tunnel was constructed, consisted of quite plastic clay, and it is therefore necessary to keep air pressure on; about ten or twelve pounds are generally kept on there to hold the ex- [fol. 201] cavation in position while the lining is being put in.

The first thing to be done was to build a concrete bottom and then put up laggings, we call it, forms of steel, and back of those forms were placed laggings. I think in the very beginning they used wooden laggings, but for practically all of the work afterwards they used steel plates for laggings which were stuck in starting at the bottom and built up and then the concrete was shovelled in back of that lagging as they went up. Then, when they came to the top there was a space where they could not put it in sideways, of course, because they had to have something to support it. So they had plates then that conformed exactly to the very top of the tunnel, about three feet long. Then they put in the concrete from the front until that was filled, and then they put in another plate until they got the length of the section done that way.

Q. 24. What air pressure was used in the construction of that tunnel?

A. Really, I never saw it over ten pounds, but I understand they used about twelve pounds at times; around about ten pounds, it might be a trifle over.

Q. 25. Was there any high pressure air machinery used in there?

A. I never saw it.

Q. 26. Were there any pipes for high pressure air machinery?

A. I never saw that.

Q. 27. Or for supplying higher pressure of air than the ten or twelve pounds?

A. No, sir.

Q. 28. When did you first see a pneumatic concrete placing machine used?

A. The first I saw was a big water tunnel they built, an eight-mile tunnel partly under the lake and partly on land [fol. 202] at Wilson Avenue, Chicago. It was a twelve-foot tunnel. There they used concrete placing machines all through.

Q. 29. Who was the man who had charge of the machines for lining the tunnel?

A. You mean for the City?

Q. 30. No, for the contractor?

A. The company's name, I think, was the Concrete Conveyor and Placing Company, but we had practically all our dealings with a gentleman by the name of Kirkland.

Q. 31. H. B. Kirkland?

A. Yes.

Cross-examination.

By Mr. Johnson:

X Q. 32. Mr. Ericson, I understand, sir, that you have a great many duties in your position?

A. Yes, a great many. I have got twelve big divisions in my Bureau. Each division is a pretty big thing.

X Q. 33. And when you got down to these tunnels, you say that it might be an interval of a month or longer between the times that you went down to inspect it?

A. It might have been, but I had reports from my inspectors every day; had a daily report from the inspectors.

X Q. 34. You have stated that when you went down there you never noticed in any of these tunnels any pipe for air which would be over the 12 pound pressure?

A. I saw no extra pipes, and I could see plainly the pipe that they used for filling the tunnel, that there was no other pipe.

[fol. 203] X Q. 35. You never noticed any other?

A. There were none, I am pretty sure. I remember those air locks pretty well. I built a good many air locks myself, so I am familiar with the construction of them.

X Q. 36. If it was more than a month or longer between your visits, it is possible that an air line might have been put in and taken out between your visits, is it not?

A. They would have to cut holes through the air lock—you mean extending it into the tunnel?

X Q. 37. No, getting it into the lock.

A. Of course, they could do that in a month and take it out again and make it appear as if nothing had been done at all. I presume that is possible. I do not think it is very probable.

X Q. 38. How did they excavate in the lock? Did they have drills?

A. No, that clay is very plastic. Mostly I saw them they used knives and cut it like cheese.

X Q. 39. All by hand?

A. By hand.

X Q. 40. No instruments at all?

A. I never saw anything like that in that tunnel. I guess later on—I remember they had a little harder stuff where they used a kind of pneumatic shovel in later years, but never any drilling or anything of that kind.

X Q. 41. You have no recollection of ever seeing such a thing?

A. I can not conceive of their using it in that material. I am pretty familiar with the material in Chicago in the last 43 years that I have been making constructions there all over.

X Q. 42. Are all the tunnels run through a stratum such [fol. 204] as you have described?

A. No, sir. We built our early water tunnels generally in a hard clay, much lower down of course than these tunnels, but of late years we built practically all our water tunnels through solid rock. We go down perhaps 150 to 200 feet in solid rock and built our tunnels in solid rock now. We built one tunnel many years ago, a land tunnel, that we had material somewhat similar to this, although a little bit harder than it was up there.

X Q. 43. Did you ever have to go through hard pan?

A. Yes.

X Q. 44. Would that simply be a matter of digging without the aid of tools?

A. No, sir; when we got into hard pan, it is pretty hard work. Sometimes we placed a drill there.

X Q. 45. You would have drills in such a stratum as that?

A. In hard pan, yes, sir.

X Q. 46. Mr. Ericson, will you tell me how you got the electric light wires into the heading?

A. I think they put it in considerably later. I could not tell you exactly how that was done. I have not any recollection of it. That would be a very small pipe anyway.

X Q. 47. But it would be a pipe through the shield, would it not?

A. Very likely they would have to have that, yes.

X Q. 48. And you have no recollection—

A. I have no recollection of that.

X Q. 49. They worked there with electric lights, did they not?

A. Yes.

X Q. 50. And they had to get the electric lights into that shield some way, did they not?

A. Yes.

[fol. 205] X Q. 51. And it had to go through the lock?

A. Yes, but we would not notice such a little pipe. If there was a large pipe I would certainly notice it; I would hear of it.

X Q. 52. What do you mean by a large pipe?

A. You mean to bring the compressed air in?

X Q. 53. I am asking you what you mean by a large pipe. You say you would not have noticed a pipe big enough to carry several electric light wires into the heading. What is a small pipe that would carry some of those wires that have to go in there, with relation to a small pipe that would carry compressed air, for example?

A. You have to have—it depends on how much compressed air you want to place in there. What would the high pressure compressed air be used for? If you tell me that, I can answer the question a little better. What purpose would it be used for? For drilling purposes?

X Q. 54. For any purpose that it was necessary to use it for. If you happen to hit a boulder or hard pan, or anything. I do not know, of course.

A. Of course, I will not say this positively. I do not think they ever used any blasting in there. On boulders, I think they simply dug a grave for them and buried them and carried right on.

X Q. 55. But they might have blasted them, might they not, between the times of your visits?

A. I think I would have known about it and heard of it. I never heard any blasting in the tunnel under air pressure. That was about ten pounds air pressure. I never heard that they did that in that tunnel.

[fol. 206] X Q. 56. But you do know that they got the electric lights into the heading and they went through a pipe through that shield?

A. I can not tell you about that pipe. I did not see it at the time.

X Q. 57. But you know they had electric lights there?

A. Yes.

X Q. 58. And they had to get through the shield for the pipe, did they not?

A. I assume so. I do not assume they put it in in any other way. They did not put it in from the top.

X Q. 59. Mr. Ericson, in that heading and the longer tunnel, they had to have hangers for the electric light wires, did they not?

A. I do not remember whether they used hangers or small brackets on the sides. I do not remember that. I did not pay so much attention to that as to the construction work itself.

X Q. 60. But how did they make the holes for the fastenings for these hangers or brackets, and so forth?

A. They do not take much of a hole, for that. You can drill a little hole in concrete. You do not have to have any special machinery for driving a little hole for hanging a wire.

X Q. 61. I am talking about getting through the shield into the heading.

A. That is what I am talking about.

X Q. 62. And there were hangers that had to be supported on the wall?

A. Either hangers or some little brackets on the side of the tunnel, I do not remember. That is a very small matter.

X Q. 63. You do not remember how they were supported?

A. No, I do not remember how those lights were supported.

[fol. 207] X Q. 64. Mr. Ericson, you are not the Director of Public Works of the City of Chicago, are you?

A. With the Director.

X Q. 65. You are not the Director?

A. No; I am the City Engineer.

X Q. 66. Mr. Artingstall, who has previously testified in this case, is not in your department, is he?

A. Not since three years ago. He occupies a small room in my department, that is all, and he reports now directly to the Commissioner of Public Works on the work he has in hand.

X Q. 67. He is not under your jurisdiction?

A. Not now, no, sir.

X Q. 68. Are not all the Municipal piers and harbor work under the Harbor Master of the City of Chicago?

A. Not the construction—the Harbor Master has simply charge of the operation of vessels, and he gives permits for the rebuilding of docks and so on, but in any big construction, the Harbor Master, at least never before, had anything to do with construction. For instance, this Municipal Pier, the Harbor Master had nothing whatever to do with.

X Q. 69. That was only assigned to the Harbor Master about two or three years ago?

A. The Harbor Master was assigned as a superintendent over the finished pier sometime ago; but, as I say, they are building a kind of breakwater now that I think the Engineer of the Harbor Master has supervision over. But that is the first I ever heard of the Harbor Master ever having anything to do with the construction of piers, except, as I say, issuing permits for replacing and repairing docks.

[fol. 208] X Q. 70. Did you ever read the Ordinance of the City of Chicago establishing the duty of the Harbor Master?

A. Yes, I read that.

X Q. 71. Are you familiar with that?

A. I have not read it for a long time, but that can be verified.

X Q. 72. How long since you have read the City Ordinance relating to that thing?

A. I do not remember; I think quite a long time.

X Q. 73. Several years?

A. Possibly.

X Q. 74. About how long would you say, roughly?

The Court: That is a waste of time. I do not care how long ago he read it.

A. The Harbor Master used to be a subordinate of the City Engineer until about 10 years ago.

X Q. 75. Mr. Ericson, was not Mr. E. C. Shanklin the Chairman of the Harbor & Subway Commission, the successor of the Harbor Commission?

A. I was Chairman for the first two years, I believe, and Mr. Shanklin succeeded me as Chairman. I think it was a short time before I returned to full duty as City Engineer. But I was Chairman when it was organized, and I was during the time the Harbor plans for the pier were made, I mean the preliminary plans. The detail plans were made afterwards while Mr. Shanklin was Chairman.

X Q. 76. And those detail plans were made by Mr. Artingstall who has previously testified, were they not?

A. I understand that a man by the name of Zaline was the Chief Draftsman under Mr. Shanklin's direction for all those plans.

[fol. 209] X Q. 77. Was he not a draftsman under Mr. Artingstall?

A. If he was, it is more than I know about it. I never heard of that. Zaline was there during the entire time I was Chairman, and he did not work under Mr. Artingstall at all. He took orders direct from the Board of Commissioners. If there was anything of that kind, it happened afterwards.

Redirect examination.

By Mr. Cox:

R. D. Q. 78. Just one point: How far below the surface are these Illinois tunnels that we have been talking about?

A. As they are built now, the bottom is about 30 feet below the surface.

R. D. Q. 79. What is the character of the stratum there?

A. As I said, every time I was in there and tested the material, it was generally quite plastic clay, blue clay.

(Adjourned to October 7th, 1926, at 10:30 A. M.)

Alfred Slade, called as a witness on behalf of the plaintiff, in rebuttal, being duly sworn, testifies as follows:

Direct examination.

By Mr. Cox:

Q. 1. Mr. Slade, where do you reside?

A. In Chicago, Illinois.

[fol. 210] Q. 2. What is your occupation?

A. Civil engineer.

Q. 3. What is your present work?

A. As chief engineer of the Chicago Tunnel Company.

Q. 4. How many miles of tunnel are comprised in that Chicago tunnel system?

A. About 60, between 60 and 61.

Q. 5. Between 60 and 61 miles?

A. Yes, sir.

Q. 6. Is it in operation?

A. Yes, sir.

Q. 7. For what is that tunnel used?

A. For merchandise, transporting merchandise.

Q. 8. From different terminals to various buildings throughout the city?

A. Yes, sir.

Q. 9. Mr. Slade, I am going to ask you your age?

A. Seventy-two.

Q. 10. And what is your physical condition?

A. It could not be better.

Q. 11. Are you occupied as chief engineer of the Chicago tunnel system daily?

A. Yes, sir.

Q. 12. What did you have to do with the construction of those tunnels?

A. I was in charge of all the engineering work, plans and inspection.

Q. 13. Who was the chief engineer from 1899 to 1906?

A. George W. Jackson was the chief engineer and general manager.

Q. 14. And you worked with Mr. Jackson on the construction of those tunnels?

A. Yes, sir.

Q. 15. Are the records of the construction of those tunnels still in existence?

A. Yes, sir.

Q. 16. By the way, what connection, if any, did Mr. Jackson have with the tunnels after 1906?

A. No connection.

Q. 17. I mean with the construction of them.

A. As contractor.

[fol. 211] Q. 18. He was the contractor on the construction of the tunnels after he quit as chief engineer in 1906?

A. Yes, sir.

Q. 19. Until what date?

A. About 1910, 1909 or 1910.

Q. 20. As engineer on the construction of these tunnels, what work did you do besides making the plans and so forth?

A. All the engineering work. I was making the plans and supervising the work, seeing that it was done in accordance with the plans, anything in connection with the engineering work.

Q. 21. How frequently, if at all, did that work take you into the tunnels to watch the operations that were going on there in connection with the construction of the tunnels?

A. At the start, two or three times a day, not less than twice a day the first year.

Q. 22. How long did that continue?

A. It continued from 1899 to 1901 or 1902; the first and second periods.

Q. 23. How long were you in the tunnels daily in connection with your duties?

A. It might take an hour or two.

Q. 24. During what period were you in the tunnel daily?

A. Generally in the morning.

Q. 25. I mean what years?

A. Up to 1904.

Q. 26. What part of 1904?

A. Towards the end when I got more help.

Q. 27. After that time in the latter part of 1904, how frequently did you have occasion to go into the tunnels?

A. About every other day, I guess, when ever necessary; every other day, I should say.

[fol. 212] Q. 28. When did you become chief engineer of the tunnels?

A. In 1910.

Q. 29. Between the time when Mr. Jackson changed his relations with the construction of the tunnels in 1910, who was chief engineer?

A. We had no chief engineer.

Q. 30. Did you perform the duties of chief engineer during that period?

A. Yes.

Q. 31. During the period from 1900 up to date, how many days have you missed from your work?

A. One; on account of sickness, one day.

Q. 32. Taking the period from 1900 to 1907, just tell us briefly how the tunnel was constructed, how the work was carried on.

A. In the first place, the air locks were installed, and then the work was done—you mean how it was constructed?

Q. 33. Yes.

A. The clay was mined out a distance of about 12 feet. That was about the limit, 12 feet in the heading. Then the concrete was brought in in small cars and the bottom was placed 12 feet.

Q. 34. What was the nature of the soil through which that tunnel was dug?

A. It was what we call medium blue clay.

Q. 35. Was there any rock or hardpan in that?

A. No, sir.

Q. 36. How was the work of excavating the tunnel and lining the tunnel done?

A. The excavating was done with what we call mining knives, a circular knife with two handles, and it was cut

out in slices. The bottom was excavated by spade or shovel.

Q. 37. By hand?

A. All by hand.

[fol. 213] Q. 38. You had some pretty powerful men working on that, did you not?

A. As high as four men on one knife.

Q. 39. And they were strong men?

A. Strong men.

Q. 40. Taking the period up to 1907, state whether any compressed air apparatus was used in the tunnel.

A. Compressed air was used up to about 12 pounds, from 10 to 12 pounds, inside of the air lock to hold back any swelling of the clay.

Q. 41. How was the compressed air of 10 or 12 pounds supplied to that air lock?

A. It was supplied from a low pressure air compressor in the basement of the buildings, and it was carried to the air lock, to the inside of the air lock.

Q. 42. Was there any other compressed air used in that tunnel?

A. Not that I know of.

Q. 43. If there had been, would you have known of it?

A. I certainly would.

Q. 44. Were there any pipes going into the air lock for compressed air?

A. No, sir.

Q. 45. During this period from 1900 to 1907, how was the concrete placed to line the walls of the tunnel?

A. Placed by hand, by shovel.

Q. 46. Any other method used?

A. No, sir.

Q. 47. At any time?

A. Not that I know of.

Q. 48. If it had been used, would you have known of it?

A. I certainly would.

Q. 49. Was there any machinery or apparatus in the heading of the tunnel or anywhere where the work of digging and lining the tunnel went on, for handling concrete or the like, pneumatically?

A. No.

[fol. 214] Q. 50. At any time?

A. Not at any time.

Q. 51. Can you state when the Tunnel Company took over the building at 177 East Monroe Street?

A. In 1904, January, I think, 1904.

Q. 52. How are you able to fix the date when the Tunnel Company took over the building at 177 East Monroe Street as 1904?

A. From an inspection made as to the condition of the building at that time.

Q. 53. Who made that inspection?

A. It was made by one of our engineers by the name of Knowles. I made the report. The report was made by me.

Q. 54. Did you have occasion to visit the building in connection with this inspection?

A. I checked it up.

Q. 55. Have you here a copy of the report made by you on that inspection, January 23, 1904 (handing paper to the witness)?

A. Yes, sir.

Mr. Cox: I offer this in evidence.

(Marked Plaintiffs' Exhibit No. 15.)

Q. 57. With this report there is a large blueprint. What does that show?

A. That was the basement, first floor and second floor of the building at 177 East Monroe.

Q. 58. And when was that made, if you are able to state?

A. January 25, 1904.

Q. 59. What was the condition of the basement floor when this report and this blueprint were made in 1904?

A. I think it was a wooden floor.

Q. 60. Was it concrete?

A. No.

Mr. Cox: I offer that blueprint in evidence.

(Marked Plaintiff's Exhibit No. 16.)

[fol. 215] Q. 61. Was the floor of that basement subsequently concreted?

A. It was.

Q. 62. By the Tunnel Company?

A. By the Tunnel Company.

Q. 63. Was any pneumatic machine used in connection with the concreting of that floor?

A. Not that I know of. I did not see any.

Q. 64. If it had been, would you have known of it?

A. I think so. I certainly would.

Q. 65. Was there any machine in that basement in 1904 for handling concrete or grout by compressed air?

A. I never saw one.

Q. 66. If there had been one there, would you have seen it?

A. I think so, yes, sir.

Q. 67. Prior to the time when the Tunnel Company took over this building in 1904, how was it occupied?

A. By different firms in different businesses. I do not remember what businesses were in there. It was not an office, it was not occupied as an office.

Q. 68. Did Mr. Jackson or anyone connected with the Tunnel Company have anything in there prior to 1904?

A. No, sir.

Q. 69. Can you state when that building, the basement of that building at 177 East Monroe Street, was connected with the tunnel in the street?

A. I think about July, 1904, July or August.

Q. 70. How was that connection made?

A. By a shaft connecting to a turn-out, as we call it; a turn-out from the main line on Monroe Street.

Q. 71. It was a turn-out from the main line of the tunnel on Monroe Street that went into the building?

A. Under the sidewalk.

[fol. 216] Q. 72. What connected that——

A. A vertical shaft from the basement to the turn-out.

Q. 73. What was in that shaft?

A. An elevator, a freight elevator.

Q. 74. Do you know when that elevator was installed?

A. In August, 1907.

Q. 75. In August of what year?

A. 1904, I mean.

Q. 76. Have you the record of the construction of that turn-out from the main tunnel to connect the basement of 177 East Monroe Street?

A. Yes, sir.

Q. 77. Is this it (handing paper to witness)?

A. Yes, sir.

Q. 78. Please give us the dates of the beginning and completion of the work of constructing that turn-out.

A. On the east end it was started on June 17, 1904, and on the west end, June 15, 1904, and completed; they met, on July 21, 1904.

Mr. Cox: I offer that in evidence.

(Marked Plaintiff's Exhibit No. 17.)

Q. 79. After 1904, was concrete mixing done in the basement of 177 East Monroe Street; I mean was concrete mixed there?

A. I do not recall. I do not think so.

Q. 80. I mean for the tunnel?

A. No, the tunnel was completed in that district in 1904.

Q. 81. By the way, this part of the tunnel that connected with 177 East Monroe Street was the section of the tunnel known as what shaft?

A. No. 1.

Q. 82. What other name did it have, if any?

A. Powers & O'Brien was the general name.

[fol. 217] Q. 83. Why was it called Powers & O'Brien?

A. Because it was under their saloon, Powers & O'Brien's saloon on Madison Street.

Q. 84. That is to say, the shaft No. 1 was put in there?

A. Shaft No. 1 was put in from that basement.

Q. 85. Just tell us briefly how the key of the tunnel lining was placed in all that work up to 1907, say.

A. The key was put in—as the walls were brought up, the key nearest the completed work was put on in three foot sections by shoveling and another three foot section, and the last three was left open because the forms were set up right against the clay. There was no way of getting the key in. You would have to get it in from the end and the end was up against the clay.

Q. 86. Have you here an illustration showing how the tunnel was excavated and lined (handing paper to the witness)?

A. That is taken from a photograph.

Q. 87. Was it all done in that manner?

A. It was all done in that manner.

Mr. Cox: I offer that in evidence.

(Marked Plaintiff's Exhibit No. 18.)

Q. 88. What are those lines in the earth?

A. That is from the circular knife. The clay was cut with a circular knife and it shows it there like a sausage.

Q. 89. And the key was put in last by shovels and rammed?

A. Shovels and rammed, except the last three feet which could not be reached on account of being up against the clay.

[fol. 218] Q. 90. How was that placed?

A. That was placed the following day.

Q. 91. This picture shows a portion of the key left?

A. Yes, sir.

Q. 92. Which will be filled in the following day when the heading advances far enough for the men to work?

A. That was the first day's work, and the second day's work ready to be concreted, and it shows that before they mined, they could not put in the last three feet of the key.

Q. 93. What kind of concrete was used in the lining of that tunnel?

A. An inch to an inch and a half stone or gravel, part crushed stone and part gravel, and the mixture was one part of Portland cement, three parts of sand, and five of crushed stone.

Q. 94. So it was five-ninths stone?

A. About an inch and a half crushed limestone or gravel.

Q. 95. How was the concrete taken into the tunnels for the lining?

A. In small cars about a half yard in capacity.

Q. 96. And how were they drawn?

A. Small mules.

Q. 97. Why did you use small mules?

A. A large one could not get through the air lock.

Q. 98. How large was the door in the air lock, about?

A. I think it was about thirty inches wide and not more than four feet high.

Q. 99. What was the consistency of the concrete used in lining the tunnels, including the arch?

A. It was dry concrete, not wet.

Q. 100. That is to say, concrete that has just enough water in it to hydrate the cement?

[fol. 219] A. Yes, just enough to mix, so that it will mix properly.

Q. 101. And that was placed in the forms, I understand you say it was rammed to solidify it?

A. Yes, tamped.

Q. 101a. Did the specifications under which you were working require that kind of concrete?

A. Those were the specifications.

Q. 102. Was the use of wet concrete permitted on that job?

A. It was not used in any place.

Q. 103. Did the city have anything to say about the nature of the concrete that went in?

A. They had everything to say about it.

Q. 104. Did they require the use of that kind of concrete?

A. That is what they required.

Q. 105. If wet concrete had been used at any time in the arch of the tunnel, what would have been the effect?

A. In the key?

Q. 106. Yes.

A. It would have fallen out, it would not have stayed up there.

Q. 107. It would not remain in place?

A. No.

Q. 108. How long did the Tunnel Company occupy that building at 177 East Monroe Street?

A. Up to 1912, I think; 1912 or 1913.

Q. 109. Were any pneumatic grout machines used in that tunnel and if so, when?

A. Yes, they were used in 1907.

Q. 110. And for what purpose?

A. For tamping leaks.

Q. 111. Was that the first time that any pneumatic machine of that kind had been used?

A. That I know of.

Q. 112. If any other machine had been used, would you have known of it?

A. I would.

[fol. 220] Q. 113. And where was that first use of the pneumatic machine?

A. That I know of, near the river between Madison and Washington Streets in the shaft.

Q. 114. What was that shaft called?

A. Jackson's Disposal Station, was the name of the shaft.

Q. 115. Have you any record of that?

A. I have.

Q. 116. And does that record show that pneumatically placed grout was first used at that time?

A. It states the day they started using it. It was the first time we used it, November, 1907.

Q. 117. Just describe briefly the machine that was used at that time in 1907.

A. It was a circular tank like a boiler about three feet high and thirty inches across, perhaps a little higher than that, with a top and bottom and a connection on top and a connection at the bottom, and it was filled with the grout almost up to the top, and then the opening was closed and the air was turned on from an air tank, and the grout was shot into the bottom opening through a two inch pipe into the walls of the shaft.

Q. 118. Where was the compressed air let in to place the grout?

A. Near the top.

Q. 119. Anywhere else?

A. No.

Q. 120. What kind of grout was used?

A. Pure cement and water.

Q. 121. Was sand used sometimes?

A. Not frequently, very seldom, not in that case.

Q. 122. Was any gravel used in that machine?

A. Never.

[fol. 221] Q. 123. Do you know how the electric light wires were taken in through the air lock?

A. They were taken through a small pipe through the air lock, about an inch pipe, I think.

Q. 124. How long was that pipe?

A. The length of the air lock. The air lock varied; about 20 feet at the most.

Q. 125. Then the pipe for the electric lighting wires was just long enough to extend through the air lock?

A. Through the air lock.

Q. 126. What was on each end of that pipe?

A. There was a nipple and that was closed up tight and taped to keep the air from escaping through the lock.

Q. 127. And the electric wires ran through that short pipe or tube into the air lock?

A. Yes.

Q. 128. How were the brackets which held the electric lights in the air lock fastened?

A. They generally consisted of a spike driven into the wall.

Q. 129. Driven into the concrete wall?

A. Yes.

Q. 130. Where did you get the compressed air to run that grouting machine in 1907?

A. From an air compressor on top, on the surface.

Q. 131. On top of the shaft?

A. Yes.

Q. 132. On the street?

A. On the sidewalk.

Cross-examination.

By Mr. Johnson:

X Q. 133. In this Plaintiff's Exhibit 15, if I understand correctly, that is your report of the condition of the building at 177 to 179 Monroe Street; is that correct?

A. Yes, sir.

X Q. 134. It is dated January 23, 1904. Did your com- [fol. 222] pany take possession of that building then, buy it?

A. We rented it.

X Q. 135. You rented it from that day?

A. I would not say that. That is the day that we inspected the condition of the building in order to see what was necessary to do in order to be able to occupy it. That is just the engineer's report to the president of the company showing the condition of the building at that time.

X Q. 136. How soon after the date of this report did you move into that building, sir?

A. Three months, I should say.

X Q. 137. Was the building fixed up before you moved into it?

9. Not entirely, no.

X Q. 138. What was done, sir?

A. The alterations were not complete. After we moved in they completed the alterations.

X Q. 139. What do you mean by "alterations," sir?

A. It was not built for an office building and we changed it into an office building. We changed one floor at a time and the other floor was changed into an apartment. Mr. Jackson was living there. It took quite a time after we moved in to complete the work.

X Q. 140. But that work was completed in three months; is that right?

A. No, I say we moved in in three months. The work was not completed, I do not think, in that year, even, the entire work up above.

X Q. 141. You mean the partitions above the first floor were not completed?

A. Yes.

X Q. 142. Was everything completed below the second floor, within, say three months?

A. I can not say that.

[fol. 223] X Q. 143. What is your best recollection?

A. I should say they worked for quite a time there. I could not say that they finished it on a certain day.

X Q. 144. I am not trying to pin you down to any particular day, Mr. Slade. I only want to know approximately when the alterations below, say, the second floor, were completed?

A. Oh, around June or July.

X Q. 145. Of 1904?

A. Yes.

X Q. 146. And the other alterations above the second floor were done shortly after that, I take it?

A. Yes.

X Q. 147. Before you moved in, the building was made sanitary and habitable, was it?

A. Partly so.

X Q. 148. You do not mean that you moved into a building that was not habitable, do you?

A. As an office?

X Q. 149. As an office or for any other use.

A. You might call it, what you mean by "habitable." You can have a swell office or you can have one that was not completed like mine was. Mine was not completed for a year and still I was there.

X Q. 150. I mean the ordinary meaning of that term, sir, and if you have any other meaning than that you can answer the question with that meaning in mind.

A. If I wanted to say what I think I would say we made the best of the conditions.

X Q. 151. When you moved in, then, the building was in pretty good condition?

A. Fairly good condition.

X Q. 152. I take it that when you moved in, it was not [fol. 224] unsanitary, at least?

A. It was not unsanitary.

X Q. 153. And it was clean?

A. We come back to the same old question of what you mean by being clean. It was not clean as compared to present-day meaning of clean.

X Q. 154. I mean so dirty as to be offensive?

A. It would never be passed as an office at best, when all the work was completed.

X Q. 155. What I am trying to bring out, sir, is when you moved in, the building was not so unclean as to be offensive?

A. No.

X Q. 156. I notice that on page 2 of Exhibit 15, of your report, you state that the condition of the basement was as follows: "Front half of basement is occupied by numerous families of cockroaches of such proportions that it would be impossible to give anything like an adequate description." Was that condition overcome before you moved in, sir?

A. I guess they got rid of the cockroaches.

X Q. 157. In the third paragraph of that phrase in relation to the first floor, you state: "Sickening odor of sewer gas pervades the rear portion, all in a filthy and unwholesome condition. A more minute description would simply end up with filth and rubbish. A fairly good-looking wash bowl and W. C."—is water closet, I suppose—"is at the

immediate rear of the general dining room." Was that condition also remedied before you moved in, sir?

A. Finally.

X Q. 158. You moved in in about three months, you said?

A. Yes, sir.

[fol. 225] X Q. 159. That would be about April, 1904?

A. As near as I can remember.

X Q. 160. I think you stated that you made a concrete connection with the basement of this building and the tunnel as shown in Exhibit 17. That was done, as I remember it, in June or July of 1904?

A. 1904.

X Q. 161. When was the basement of this building concreted, sir? At the same time?

A. Yes.

X Q. 162. So that the building at 177 East Monroe Street was concreted in June or July of 1904, according to your recollection?

A. I would not say that all of it was concreted at that time, no, sir.

X Q. 163. Was most of it concreted, sir? After you once started it, did you not complete the concreting?

A. The basement had tracks and so forth in it and I can not say what time we completed it.

X Q. 164. With the exception of the portion of the floor covered by the tracks, it was concreted in June or July of 1904?

A. I think so, but the tracks covered a great part of the basement.

X Q. 165. How far did you push out the tunnel from this basement, at what rate of speed were you travelling?

A. Building of the tunnel?

X Q. 166. Is my question correct? That is, you connected the basement with the tunnel. Had the tunnel already been built, sir?

A. Yes, sir.

X Q. 167. How long before had the tunnel been built, sir?

A. About two years.

X Q. 168. About 1902, then?

A. Yes.

X Q. 169. How long was the tunnel then; several miles?

A. Several miles.

[fol. 226] X Q. 170. About how many miles would you say?

A. I could not give you that.

X Q. 171. Could you give me any estimate?

A. 1904 was about the second period. It would be quite a number of miles, feet I mean, several thousand feet. I do not remember. My records would show it.

X Q. 172. But the tunnel extended several miles?

A. Yes, sir.

X Q. 173. When you were building the tunnel were you troubled with leaks in any way?

A. Water?

X Q. 174. Yes.

A. No, sir.

X Q. 175. You had no trouble with water at all?

A. In the tunnel, no, sir.

X Q. 176. Mr. Jackson to whom you referred was continually using new devices, was he not?

A. At times, yes, trying to.

X Q. 177. Might he not have used some devices that you did not see?

A. I do not think so.

X Q. 178. But it is possible, I take it?

A. I hardly think so.

X Q. 179. You would not want to swear positively that you saw everything that he was working on, would you?

A. I could pretty near swear, because if he had anything, I would be the first to know it.

X Q. 180. That is, you think he would have told you about it?

A. I would not have known if he had any reason to hide it, but anything that was worth anything, I certainly would have known it. If he had any improvements, since I made the estimates of the cost of the work, I would certainly be interested in knowing anything that would cut down the [fol. 227] cost, and I was pretty close to Jackson myself, having worked with him from the World's Fair in 1893.

X Q. 184. Do I understand that you swear that you saw every——

A. No, sir, I do not swear that. I said I could safely swear.

X Q. 182. But you do not?

A. Because he might have made an experiment out at some other place. I do not claim that I saw everything that Jackson did.

X Q. 183. Did you see everything that Jackson or anyone else tried out in these tunnels?

A. If it was an experiment of any importance, any size, I certainly did.

X Q. 184. Exactly what do you mean by "experiment of any size," sir?

A. If it lasted for several days. Of course, an experiment that lasted for an hour or two, I might not perhaps have seen it.

X Q. 185. Did you see the operation of the rammer?

A. I did not hear that.

X Q. 186. Did you see the operation of the concrete rammer in the tunnels?

A. Concrete rammer?

X Q. 187. Yes, sir.

A. I never heard of it.

X Q. 188. Would you swear that he never tried out a new concrete rammer in the tunnel?

A. No.

X Q. 189. How far is shaft No. 1 from the beginning of the tunnel work?

A. The beginning of the tunnel work?

X Q. 190. Yes, sir.

A. About 100 feet, I should say.

X Q. 191. Do you know anything about a Chicago Pneu- [fol. 228] matic Company hammer being used in that tunnel?

A. At what period?

X Q. 192. At any period?

A. I do.

X Q. 193. What period do you remember it?

A. We are using it now.

X Q. 194. When did you begin using the Chicago Pneumatic Company hammer?

A. About 5 years ago.

X Q. 195. You do not know the use of any Chicago Pneumatic hammer in the tunnel before five years ago?

A. Yes, sir, they used it before that.

X Q. 196. About how long before that?

A. About ten years ago, but we did not use it.

X Q. 197. But it was used in the tunnel?

A. It might have been; I will not say for certain.

X Q. 198. Was it used for any unusual purpose?

A. No, sir.

X Q. 199. It was used at least some ten years ago, is that it? Would that be the first use in the tunnel as far as you know?

A. I would not say that.

X Q. 200. It might have been used long before that?

A. We had pneumatic hammers for drilling holes in the tunnel walls quite a number of years, small machines for drilling a half inch or a quarter inch hole. The company has been using those right along.

X Q. 201. That is, from the beginning of the job?

A. No.

X Q. 202. About when?

A. The tunnel was constructed in different periods. During the construction period we did not use any of those instruments. Afterwards, when we started equipping the [fol. 229] tunnel for handling freight, about 1912 or 1914, then we used these new instruments.

X Q. 203. But a Chicago Pneumatic hammer might have been used in the tunnel for some purpose that you did not know about before that, might it not?

A. Not during the construction period.

X Q. 204. Do you know anything about a switch being tested out in the tunnel, sir?

A. A switch?

X Q. 205. Yes, an automatic switch, track switch.

A. An automatic switch?

X Q. 206. Yes.

A. We have a number of them.

X Q. 207. I mean a test of them many years ago, an experimental device?

A. I do not recall it.

X Q. 208. Did you ever hear of such an experiment in the tunnel?

A. An automatic switch?

X Q. 209. Yes.

A. I do not recall.

X Q. 210. I will ask you as an engineer, Mr. Slade, if your low pressure compressors could not have been built up so that you could get a higher pressure?

A. No, sir.

X Q. 211. You never knew that they were coupled up so that they would get additional pressure?

A. They were built the maximum 35 pounds, and a greater pressure they would not stand. They were only used for 10 or 12 pounds.

X Q. 212. Do you know if Mr. Fanning ever made cars for the Illinois tunnel?

A. I do not know—cars?

X Q. 213. Cars for the tunnel?

A. What kind of cars?

X Q. 214. Answer it in your own way, if you will.

A. Because we had various styles of cars.

X Q. 215. Any kind of cars?

[fol. 230] A. He might have made some small wooden cars, I would not pass on that.

X Q. 216. You would not know about that?

A. I would not know particularly, no.

X Q. 217. I have just found out that the cars that I referred to being built by Mr. Fanning were concrete cars, both wood and steel. Do you know anything about such cars being built by him?

A. No, sir, I do not know.

Mr. Cox: You do not claim they were built in the tunnel, do you?

Mr. Johnson: Oh, no.

X Q. 218. Do you know anything about a shield test being tried out in the tunnel?

A. A driving shield?

X Q. 219. Answer it in your own way, I leave that to you.

A. I do not understand the question.

Mr. Johnson: Read the question, please.

(X Q. 218 read.)

A. We tried one, yes.

X Q. 220. Describe it, please.

A. That was in the large tunnel, 13 or 14 foot tunnel. We drove a shield made of Jackson patented sheeting as it is called.

X Q. 221. Would you call that a test of an electric driven shield?

A. I knew nothing about that. We had no electric power.

X Q. 222. Are you familiar with the building of the tunnel for the Disposal Station?

A. Jackson's Disposal Station?

X Q. 223. Yes, sir.

A. Yes.

[fol. 231] X Q. 224. About what time was that?

A. 1906 or 1907; 1907.

X Q. 225. And that was connected to the Illinois tunnel?

A. Yes, sir.

X Q. 226. Did you have any trouble with water in that shaft?

A. Yes, sir.

X Q. 227. How did you overcome that difficulty?

A. By a grouting machine.

X Q. 228. What kind of a grouting machine?

A. Like the one I described. It is a tank with a connection on top and an outlet at the bottom, and that tank was filled with grout and shot in, refilled and shot in again.

X Q. 229. About how much pressure did you use?

A. About 100 to 125, around that.

X Q. 230. How far did you shoot the grout?

A. Shot it in the river. I have shot it right into the river.

X Q. 231. How far from the reservoir, say, did the hose run or would your pipe run?

A. A short distance.

X Q. 232. About how far?

A. I could not say; about 10 or 20 feet at most, through a two-inch pipe.

X Q. 233. That was shot through a two-inch pipe?

A. Yes, sir.

X Q. 234. And that stopped the leak?

A. Yes.

X Q. 235. When you got one bad leak in that tunnel, that leak was quite serious, was it not?

A. That is——

X Q. 236. And you had to get a grouting machine pretty fast, did you not?

A. Jackson got that. Jackson was doing that work.

X Q. 237. So that you are not familiar with it?

[fol. 232] A. I am familiar with it. I was there every day, but he was doing it by contract. That was his job, and it was his job to stop the leak.

X Q. 238. And Jackson got a grouting machine right away, did he not?

A. No, he did not, not according to my records, they did not show he got it right away.

X Q. 239. How long before he got it?

A. I do not recall.

X Q. 240. But he stopped that bad leak with a grouting machine, did he not?

A. Partly, and partly it was stopped by dumping clay in the river along-ide of where the leak was. It was stopped from the outside.

X Q. 241. Did you not also have trouble with water leaking into the tunnel under the Polk Street drift?

A. Yes, sir.

X Q. 242. And you had to grout that?

A. Yes, sir.

X Q. 243. And you had to grout that right away, did you not?

A. As soon as we could.

X Q. 244. And Jackson did that?

A. I do not know whether he did or not.

X Q. 245. Or Jackson's men?

A. I think Jackson's men, I am not sure.

X Q. 246. You also had trouble with the Marshall-Field Warehouse connection?

A. What would you call trouble?

X Q. 247. A bad leak, sir, water coming in the shaft?

A. At Marshall-Field's?

X Q. 248. Marshall-Field's connection?

A. We had no shaft in Marshall-Field's.

X Q. 249. Marshall-Field's Warehouse?

A. We had one.

X Q. 250. And that had to be grouted?

A. Yes.

[fol. 233] X Q. 251. And grouted quickly?

A. No, I won't say quickly.

X Q. 252. And Jackson did that?

A. He was working on that also.

X Q. 253. If you do not stop these leaks in the tunnel immediately there is so much water coming through with the cutting action that you are apt to have the tunnel seriously damaged, are you not?

A. We pump it out a- fast as it comes in.

X Q. 254. But the erosion action, you want to avoid that, do you not?

A. We never had any erosion action. The water does not cut the clay at all. We never had any trouble with erosion.

X Q. 255. You as an engineer know that the water does not come through the clay. It comes through pockets of gravel in the clay, does it not?

A. It might be through a seam, yes. We have maybe a seam of half an inch or a quarter of an inch in the clay, and it comes through that.

X Q. 256. So that the water comes down that pocket or the seam rather than through the clay?

A. It will not come through clay. Clay is water-proof.

X Q. 257. Do your drawings in relation to this tunnel have to be approved by the City Engineer of the City of Chicago?

A. All permits.

X Q. 258. Who was the City Engineer of the City of Chicago from 1919 to 1923?

A. Mr. Ericson, I think.

X Q. 259. Mr. Ericson from 1919 to 1923?

A. I will not say. I can not say that every permit was signed by Mr. Ericson. I would not say that.

[fol. 234] X Q. 260. Was he City Engineer during that period?

A. They were signed by a City Engineer. Whether it was Mr. Ericson or not, I do not know.

X Q. 261. Do you know P. S. Coombs?

A. He used to sign.

X Q. 262. Was he not City Engineer?

A. He was.

X Q. 263. And also was not Alexander Murdock City Engineer?

A. Yes.

X Q. 264. And then John Ericson was the City Engineer four or five years, is that so?

A. They say the others were not.

X Q. 265. What do you mean?

A. They claim that the other man had no right to be City Engineer during that period, especially Murdock, for instance. He was made City Engineer and it was found afterwards that he had no right to be City Engineer, but he signed as City Engineer.

X Q. 266. He actually occupied the office and signed the permits and so forth as City Engineer?

A. I could not say.

X Q. 267. Was it Mr. Ericson or P. S. Coombs, or Alexander Murdock?

A. Murdock signed some, I know.

X Q. 268. And Coombs signed some?

A. Yes. We are not interested in the name of the City Engineer.

X Q. 269. Was it not the general practice to first sink a small shaft from the basement so as to dispose of the excavation?

A. In the basement?

X Q. 270. A little working shaft, did not you build that first?

A. A working shaft? All of the work was done from a working shaft.

[fol. 235] X Q. 271. Then you might have put out a small working shaft before you ran the tunnel, might you not?

A. We had to.

X Q. 272. And there might have been an interval between the building of the tube?

A. No.

X. Q. 273. How long an interval would you say?

A. As soon as the working shaft was completed the other work was started. That would be the layout.

X Q. 274. How was air conducted through the tunnel when you operated pneumatic hammers?

A. We had an air compressor.

X Q. 275. You had a what?

A. An air compressor.

X Q. 276. Was the air compressor in the tunnel or was it outside and brought in by pipes?

A. No.

X Q. 277. Which way was it?

A. A small air compressor on the car.

X Q. 278. You used that in the tunnel?

A. Yes. That was not in during construction; there was none used during construction that way.

X Q. 279. Was there a reservoir tank on that tank, sir?

A. Sir, a small one.

X Q. 280. How high a pressure was that, sir?

A. That I could not tell you.

X Q. 281. It had to be something like 50 or 75 pounds to operate the hammers, did it not?

A. The hammers we used to operate at less than that.

X Q. 282. About what, sir?

A. I could not tell you that. Ours were only used after the construction and had nothing whatsoever to do with the construction period or Jackson.

[fol. 236] JOHN LYNCH, called as a witness on behalf of the plaintiff, in rebuttal, being duly sworn, testifies as follows:

Direct examination.

By Mr. Cox:

Q. 1. Mr. Lynch, where do you reside?

A. Chicago, Illinois.

Q. 2. What, if anything, did you have to do with the construction of the tunnels known as the Illinois Tunnels?

A. Inspector on them.

Q. 3. Well, for what?

A. For the City of Chicago.

Q. 4. During what years?

A. From February 1st, 1900, up to date.

Q. 5. During the period from 1900 to 1907 what were your duties as inspector?

A. To see that they had a permit for all work that was done, and did the work according to specifications, that is in the size and concrete used.

Q. 6. And what interest had the city in the construction of that tunnel?

A. There was an ordinance passed giving them the right to go under the streets, and they came under the supervision of the Commissioner of Public Works.

Q. And what was the object of your inspection, to see that the work was done?

A. That they did the work according to the ordinance passed by the City Council.

Q. 8. And did that ordinance contain specifications as to just how the work was to be carried out?

A. Not the ordinance.

Q. 9. Well, what?

A. The specifications were drawn in the engineer's office.

[fol. 237] Q. 10. The City Engineer?

A. As I understand it.

Q. 11. Was it your duty to see that the work was carried out according to specifications?

A. Yes, sir.

Q. 12. How often did you visit the tunnel during that period from say 1900 to 1907, inclusive?

A. My hours were from 1 P. M. to 11 P. M. only when I took off probably three hours in that time for lunch and dinner.

Q. 13. Were you on the job every day during that period?

A. Yes, sir, with the exception of once when I took a vacation.

Q. 14. Was it your duty to see everything that was going on in that tunnel?

A. Yes, sir. I and Mr. Northway, the other man from the Inspector's office. He was not an inspector, he was an engineer.

Q. 15. You were the inspector and he was the engineer?

A. Yes, sir.

Q. 16. Now, how was that tunnel lined?

A. By concrete.

Q. 17. Do you remember the section of the tunnel known as shaft No. 1?

A. Yes, sir.

Q. 18. How was that lined?

A. Concrete.

Q. 19. In any other way?

A. Not to my knowledge.

Q. 20. Well, if it had been would you have known it?

A. Yes, sir.

Q. 21. Were any machines used there for placing concrete or anything else pneumatically by compressed air?

A. I have never seen any of them.

Q. 22. If there had been one would you have seen it?

[fol. 238] A. I was in the tunnel, as I say, when they were concreting, and if there was a machine there I would cer-

tainly have seen it; and if I did not see it Mr. Northway would see it and also report to me.

Q. 23. You would have both seen it, would you not?

A. Yes, sir.

Q. 24. You reported to each other what you saw, is that it?

A. Yes.

Q. 25. And what one saw both saw or none saw?

A. Yes, sir.

Mr. Johnson: I object to that. This witness can not testify to what another man saw.

The Witness: I said he reported to me.

The Court: Overruled.

The Witness: He was on the job up to 1905. He was assigned in 1899 and while the work was shut down he was off.

Mr. Johnson: That is hearsay evidence. Let the witness testify.

Mr. Cox: I did not ask him anything.

Mr. Johnson: I move to strike it out.

Q. 26. Now, how was the work of excavation and lining that tunnel carried on?

A. The lining?

Q. 27. Yes, but what was the compartment in which the men were working and in which the work was done? How was it defined? How was it made? Was it under pressure?

A. Air pressure.

Q. 28. Yes, and that held the air pressure in the end of the tunnel in which the men were working and going forward?

A. Locks.

[fol. 239] Q. 29. About what was that pressure?

A. Between 10 and 12 pounds.

Q. 30. You had occasion to go in there frequently, did you?

A. Every day.

Q. 31. Were there any pipes going through any lock or into that lock?

A. There was about a three inch pipe between the locks for the air that went in the frame, that is above the door, and the pipe for the electric wires, an inch pipe.

Q. 32. Did that three inch pipe extend into the locked compartment?

A. Yes, sir.

Q. 33. How far?

A. Just inside the lock.

Q. 34. Just inside the partition?

A. Yes, sir.

Q. 35. And that conveyed a pressure of what?

A. About 10 or 12 pounds.

Q. 36. Ten or twelve pounds. Was there any other pipe running through the lock?

A. Not that I saw.

Q. 37. Well, if there had been would you have seen it?

A. Yes, sir.

Q. 38. Were there any other pipes running up to the place where the men were working or where the concrete was placed?

A. I never saw them.

Q. 39. Had there been any would you have seen them?

A. If it was at the time while I went in there. As I say, I was off once during that time on a vacation.

Q. 40. When was that?

A. Well, I think it was along in 1904.

Q. 41. How long was your vacation?

A. Only two weeks.

Q. 42. Two weeks, in the summer?

A. Yes.

Q. 43. Now, did they use any drills or other pneumatic machines in the tunnel during that period?

[fol. 240] A. Well, that I would not be interested in; only the construction of it.

Q. 44. Was it your duty to see just how the tunnel was excavated and how it was lined?

A. Yes.

Q. 45. And if any other method than that usually carried on had been used would you have known of it?

A. I think I would.

Q. 46. Do you remember the kind of concrete that was specified and required to be used on the lining of the tunnel?

A. Yes, sir.

Q. 47. What was it?

A. Do you mean the amounts? One, three, five.

Q. 48. What was the consistency of the concrete?

A. Dry.

Q. 49. Dry concrete. It was part of your duty to see that they put in nothing but dry concrete in there?

A. No, the engineer had charge of that end of it, Mr. Northway.

Q. 50. It was part of your duty to report what was done?

A. It was part of my duty to report what was done, but he took charge of that end.

Q. 51. Is this engineer that you mentioned, is he still alive?

A. No, he is dead.

Q. 52. You knew George W. Jackson, did you?

A. Yes, sir.

Q. 53. How well?

A. Oh, about as well as anybody could know him.

Q. 54. You came in contact with him how often during the construction of that tunnel?

A. Oh, most every evening I would meet him down in the tunnel, say three times a week.

Q. 55. During the time when you met him and were with him did you discuss the things that he was doing in the tunnel?

[fol. 241] A. Only just the work that was being done in the tunnel.

Q. 56. How were the keys of the tunnel lining placed?

A. Well, if they were going to bulkhead it they would pigeon-hole it; but if they were going to go straight ahead they would wait until the next day and put the lags in and fill about three feet and then concrete in that way.

Q. 57. Backwards?

A. With a shovel.

Q. 58. And after it was put in with a shovel, what did they do?

A. They would tamp it in.

Q. 59. Tamp it. Was any machine used for the purpose of placing that key while you were there?

A. Not that I ever saw.

Q. 60. If a machine had been used there for several days barring your short vacation, would you have known of it?

A. Yes, sir.

Cross-examination.

By Mr. Johnson:

X Q. 61. If I remember your testimony, you said you took a vacation of three weeks in 1904, is that right?

A. I said two weeks.

X Q. 62. In what time in 1904?

A. Well, that was in the summer time. That I could not recall now.

X Q. 63. Now, you were the City Inspector on that job, is that correct?

A. Yes, sir.

X Q. 64. Naturally, you were looking out for the interests of the city, I take it?

A. Yes, sir.

X Q. 65. Your main duty was to see what was going into the walls of the tunnel, and that it was up to specifications and complied with the specifications, for that job, is that right?

A. Partly, yes.

[fol. 242] X Q. 66. What other duties did you have, sir?

A. Well, partly right. I said partly. I was not held responsible for all the work, only part.

X Q. 67. What part were you held responsible for, sir?

A. For doing it according to specifications. Mr. Northway was there looking after the same kind of work that I was from the engineer's office.

X Q. 68. Then you had two inspectors in the job?

A. Mr. Northway was an engineer but he reported into the City Engineer's office daily what they were doing and how they were doing it.

X Q. 69. What did you report?

A. Every day into the Superintendent of Streets also. Two departments were taken in there.

X Q. 70. Did you report to the City Engineer?

A. I did the last six years, and before that time Mr. Northway, he used to report in there, and after Mr. Northway died, Jim Valley used to report in there.

X Q. 71. Then, if I understood you correctly, you had to see that the walls of the tunnels were built according to specifications, and that was the main thing that came under your duties?

A. Yes, and my instructions from the Superintendent of Streets were to see what they were doing in that direction and report in to him.

X Q. 72. And you reported every day?

A. To the Street Department.

X Q. 73. To the Street Department, and not the City Engineer?

A. No, sir, at that time.

X Q. 74. You were more interested in your duties than——

A. I will also state that Mr. Erieson at that time asked me to keep tab on what was going on, and drop in from time [fol. 243] to time and let him know along with his reports from Mr. Northway, which I did.

X Q. 75. How often did you drop in on Mr. Erieson, sir?

A. Oh, a couple of times a week.

X Q. 76. In his office?

A. Yes.

X Q. 77. And make out a written report or oral report?

A. Oh, no, just verbally.

X Q. 78. Just verbally?

A. That is all.

X Q. 79. During what years was that, sir?

A. That I reported into Mr. Erieson?

X Q. 80. Yes.

A. From 1900, that is when they were working from 1905 to about,—I mean from 1900 to 1905. That is when Mr. Northway was with me. After that Mr. Valley came on the job, and he reported into the Engineer's office daily, and I would just drop in occasionally then and have a talk with Mr. Erieson about how things were going on.

X Q. 81. Did you report personally to Mr. Erieson in his office during 1902, 1903 and 1904?

A. A couple of times a week when I would meet him, that is, when I met him coming through the hall or going to his office I would tell it to him.

X Q. 82. And you are positive that you made these reports to Mr. Erieson in these three years?

A. Yes, sir.

X Q. 83. From 1902 to 1904, inclusive?

A. Yes, sir.

X Q. 84. And you dropped into his office personally and saw him?

A. Yes, sir, that is the only way I could see him.

X Q. 85. And you did that during the year 1903, sir?

A. Yes, sir, as I recollect it.

[fol. 244] X Q. 86. Now, to come back again, you were not particularly interested in the equipment of the contractor as long as he did his work satisfactory, were you?

A. That was all.

X Q. 87. Now, the contractor might have been using a new device in that tunnel that did the work satisfactorily so that you would make no report on that or pay no particular attention to that?

A. Yes, I would make a report if there was any change in the method of putting in the concrete or in any way anything new or out of the ordinary I would report that to my superintendent.

X Q. 88. You would report on the apparatus?

A. Not the apparatus, but if they were doing other than the ordinary way I would report to my superintendent that they had changed the method of concreting, but I would not have anything to do with the machine or having anything to say about it. I would only report in about it and let them do it.

X Q. 89. Were there just two inspectors on this job, you and the other gentleman that is now deceased?

A. Do you mean during the whole period?

X Q. 90. Yes.

A. Oh, yes, at one time there was an inspector in every heading.

X Q. 91. Was not there an inspector named John Olis on that job?

A. Olis?

X Q. 92. Yes, sir.

A. I do not remember that name. I do not recall it. There might have been, but I do not recall it because there were seven or eight of them there.

X Q. 93. So that there were other inspectors there that you might not have known?

[fol. 245] A. Yes, only I went through every heading, that is between the afternoon and night, to see what was going on. But the other inspectors I did not pay much attention

to their names. Some of them I knew, one of them was Hugh Carr, and you got Valley's name, and Martin Hartigan. That was just for a short period. That was when Patterson was Commissioner of Public Works.

X Q. 94. Were there not several pipes lying along the floor of the tunnel going in?

A. During the construction work?

X Q. 95. Yes.

A. Not that I recall. There were pipes put in after for drainage purposes after the tunnel was completed and in those parts——

X Q. 96. Let me see if I understand you correctly. I am not talking about the heading, nor am I talking about after the tunnel was completed and turned over to the city. I do not mean that.

I mean were there not several pipes leading along the bottom as the work progressed for drainage and other purposes?

A. While the work was going on, do you mean? No, they put that in after they put in their concrete; track work, I mean.

X Q. 98. Well, are we speaking about the heading alone or are we speaking——

A. I suppose you are speaking about the sides, are you not, along the side?

X Q. 99. I am talking about the floor, sir, the bottom.

A. Yes. I never noticed any pipes in there, only for drainage purposes.

X Q. 100. And there were one or two of those?

A. Yes, as I recall it.

X Q. 101. Is it not customary and absolutely necessary [fol. 246] and usual to have a lot of spare parts all in the tunnel all along in case of emergency and these clutter up different portions of the side of the tunnel?

A. Only where they put their pumps in after the work is completed.

X Q. 102. They have to have timbers and loose pipe and a whole lot of things?

A. They would have pipes, and they would have timber if it was necessary if they met with spongy clay and sand pockets they would timber.

X Q. 103. They had emergency material on the side of the tunnel, on the side of the floor in case of emergency?

A. Yes, sir.

X Q. 104. Do you know Mr. Fanning who has testified in this case, sir?

A. Very well.

X Q. 105. He was one of Jackson's men, was he not?

A. Well, as I understand it, he was connected with the Bridge Department of the Jackson-Cordett Company. I got acquainted with John Fanning through Mr. Jackson and John Cordett. I never paid much attention to what direction he was working.

X Q. 106. You saw him around the tunnel pretty much every day, did you not?

A. No, sir, I did not.

X Q. 107. How often?

A. I would meet him in the evening once in a while, but I did not know he was connected with the tunnel. I thought he was connected with the Jackson Bridge Works.

X Q. 108. Did you ever see the tamper being used in the tunnel, sir?

A. No, sir.

X Q. 109. A concrete tamper?

A. No, sir.

Mr. Cox: What kind of tamper?

[fol. 247] X Q. 110. A pneumatic concrete tamper?

A. No, sir, I did not. I saw no tamper, only what we used by hand in the placing of concrete, with the shovel.

X Q. 111. You never saw a pneumatic tamper being used in the tunnel?

A. No, I did not.

X Q. 112. It might have been used without your having seen it?

A. Yes.

X Q. 113. Is that also true about an electric shield? Did you ever see that used in the tunnel?

A. Well, yes, at the later time I saw it.

X Q. 114. I am talking about this tunnel.

A. That is in connection with the tunnel. They had an incline run up where we hauled out our mud.

X Q. 115. What year was that, sir?

A. Anywhere between 1905 and 1908, as I recollect it. I would not be positive on the year, but they drive shields there, steel shields.

X Q. 116. But you do remember that experiment with an electric shield?

A. I do not know whether it was electricity that they drove it by. It was not an electric shield. Is that what you asked me, an electric shield?

X Q. 117. I am talking about a horizontal electric shield driven electrically.

A. No.

X Q. 118. You never saw that?

A. I never saw that. The only shield I saw there was on the lake front where they built this incline where they drove down.

X Q. 119. Did you ever see the automatic track switch that was built in the tunnel?

A. If I did, I did not pay any attention to it because that did not come under my work.

[fol. 248] Alfred J. Martin, called as a witness on behalf of the plaintiff, in rebuttal, having been duly sworn, testifies as follows:

Direct examination.

By Mr. Cox:

Q. 1. Mr. Martin, where do you reside?

A. Chicago.

Q. 2. What did you to do with the construction of the Illinois Tunnels in Chicago and when?

A. Since 1901 up to the present time.

Q. 3. Just tell us when you first saw a pneumatic placer used for placing concrete or grout.

A. Never saw any for placing concrete, but I saw one for placing cement in 1907.

Q. 4. And how frequently were you in the tunnel during that period up to 1907?

A. Every day.

Q. 5. What was your job? What did you do? What were you doing there?

A. At first I was laboring, working in the headings, then I worked at very other line of work they had, electric work, pipe work and everything.

Q. 6. In 1902, 1903 and 1904, do you remember what you were doing?

A. Mostly construction.

Q. 7. What did you have to do with the concrete work?

A. I hauled it there.

Q. 8. You supplied the concrete to the men who placed it in the forms?

A. I did.

Q. 9. Now, when you say you saw a machine used in 1907, tell us what that was.

A. It was a grouting machine. We used it over in the disposal station. It was a plant apparently about 30 inches [fol. 249] in diameter and about 4½ feet high, four feet high.

They had an air connection on top and discharge on the bottom. I operated the plant myself.

Q. 10. What air pressure did you use?

A. From 100 to 125 pounds pressure.

Q. 11. When did you operate that plant and under whom were you working?

A. I. J. Crowley.

Q. 12. Who was the contractor?

A. George W. Jackson.

Q. 13. Was there any air inlet to that tank except in the top?

A. No, sir.

Q. 14. Did you have anything to do with the work at the Polk Street Tunnel?

A. I did. I worked on that job also. I was the one that poured the grout into the bottom of the tunnel. I worked on it 24 hours without stopping at one time.

Q. 15. When was that?

A. That was in 1907 also.

Q. 16. Now, state how the grout machine resembled if at all any of these machines shown on Exhibit E?

A. It resembled the exhibit shown on A.

Q. 17. There is an "A" on each figure. Was it 3, 4, or 5?

A. 4.

Q. 18. Now, how about the air inlet?

A. No, there was only one inlet, one outlet and that was on the bottom.

Q. 19. How about the air inlet, where was that?

A. The air inlet was on the top.

Q. 20. None along in here (indicating)?

A. No, sir.

[fol. 250] Q. 21. And both of those were Mr. George W. Jackson's jobs?

A. Yes, sir.

Q. 22. Did you ever see a grouting machine used before that?

A. No, sir.

Q. 23. What was the grout that was used, what mixture?

A. Cement and water.

Q. 24. Was sand used at all?

A. A little sand was tried out but did not work right, did not push far enough, and it would clog up the pipe too easy on account of the heft of the sand, so we discontinued the use of sand, and used cement and water entirely right along on the job.

Q. 25. What was the size of the discharge pipe on the bottom?

A. Two inch reduced down to whatever hole we had made.

Cross-examination.

By Mr. Johnson:

X Q. 26. Mr. Martin, if I understood you correctly, sir, you only saw a machine like figure 4 of what we call here Exhibit I, is that correct?

A. Yes, sir.

X Q. 27. That was when, sir?

A. 1907.

X Q. 28. Have you fixed that date definitely in your mind?

A. I have fixed it definitely in my mind.

X Q. 29. Now, prior to that, if I understood your testimony correctly, you were a laborer in the heading?

A. I was a laborer at the start, yes, sir.

X Q. 30. And you did whatever you were told to do by the——

A. Whatever my boss told me to do, I did, whatever the job was I did.

X Q. 31. Do I understand you were there every day?

A. Every day.

[fol. 251] X Q. 32. Right through?

A. Yes, I have entered that tunnel now about 7,800 times not including Sundays and holidays and lots of them. About 7,800 times.

X Q. 33. 7,800 times?

A. Yes, 7,800 times.

X Q. 34. What pressure did you use on this device that you just testified to?

A. 100 to 125 pounds air pressure.

X Q. 35. Where did you get it?

A. According to how the material went through the wall and where the leak was.

X Q. 36. Where did you get the air pressure?

A. Got the air pressure from an air compressor. The air pressure was made by an air compressor into another tank and this tank fed this grouting tank according to how you wanted it.

X Q. 37. About 125 pounds to the square inch?

A. About 100 to 125 pounds, yes, sir.

X Q. 38. Was that on a truck or not?

A. It was; it was on a car.

X Q. 39. Could be run in and out?

A. In and out on the track.

X Q. 40. Did you ever see a tamper?

A. Yes, sir, I have used them.

X Q. 41. I do not mean the hand tamper, sir; I mean a mechanical tamper.

A. No, sir, what do you mean? What did I see it outside?

X Q. 42. No, I mean in the tunnel.

A. No, sir.

X Q. 43. Did you ever see a pneumatic tamper in the tunnel?

[fol. 252] A. No, sir.

X Q. 44. Did you ever see an automatic track switch tried out in the tunnel?

A. No, sir.

X Q. 45. Did you ever see an electric shield tried out in the tunnel?

A. I never seen it; I know it was tried out.

X Q. 46. Oh, you know that?

A. Yes, sir, tried out on one of our big boards on State and Lake Street, that is the exact location.

By Mr. Cox:

R. D. Q. 47. What is your present position with the Tunnel Company?

A. I am superintendent of the Maintenance Department.

Earnest A. Clark, called as a witness on behalf of the plaintiff, in rebuttal, being duly sworn, testifies as follows:

Direct examination.

By Mr. Cox:

Q. 1. Where do you reside, Mr. Clark?

A. Chicago, Illinois.

Q. 2. Were you ever connected with George W. Jackson?

A. Yes, sir.

Q. 3. What branch of his business?

A. First from 1902 to 1906 in the bridge steel department, and after that with George W. Jackson, Incorporated.

Q. 4. How long were you with him after that?

A. To 1912 or 1913.

Q. 5. Now, were you in the office of the Jackson Cordett [fol. 253] Bridge Works?

A. A part of the time.

Q. 6. During what period?

A. A part of 1903 and the early part of 1904, if I remember rightly, and after that we moved downtown to the Rookery Building, and were there to 1906, and we moved across to what is known as 754 West Jackson.

Q. 7. While you were with Mr. Jackson did you have anything to do with the making of the pneumatic machine for placing grout or something of that sort?

A. I made one of them after 1906. I could not place the exact date. I know we made it in the rear of Boston Avenue, in the place there.

Q. 8. By the way, what was your position with Jackson?

A. Chief Draftsman and Engineer.

Q. 9. This tank you say was built after 1906?

A. After 1906.

Q. 10. Just describe it.

A. It was built out of—the first one we made was built of pieces of cast iron pipe about twelve inches in diameter and about three and a half or four feet long, with a flange in the top and bottom. That is a flat flange, and the bottom flange had an opening in the center, about a two-inch opening, and the top—the first flange that we made up though had no opening but had an opening in the side of the pipe near the top, a three-quarters of an inch opening, if I remember right.

Q. 11. That was the first one you built?

A. That was the first one we built.

Q. 12. That was after 1906?

A. Yes, that was after 1906.

[fol. 254] Q. 13. What became of that?

A. They used that in some part of the tunnel work at that time, but they found out it was not practical to use it.

Q. 14. Was another one built?

A. Either another one built or purchased. I would not say positively in regard ot that.

Q. 15. Just describe that other one.

A. The other machine was a steel tank with a cone bottom. I would say it was about 18 or 20 inches in diameter, about 4 feet high and set on iron legs, with an opening in the top, on the side near the top for air; and there was an opening on the end of an elbow, or an opening in the nipple, a short nipple in the elbow, in the bottom of the machine projecting out past the outside of the machine was a shut-off valve.

Q. 16. Where was the air supplied to this tank, now, to both of them you have mentioned?

A. The air was supplied on the cast iron pipe machine, it was applied near the top on the side, and the same, about the same place on the other machine.

Q. 17. Were these the first articles of the kind that you had ever seen Mr. Jackson make or have bought or anyone connected with him?

A. Yes, sir.

Q. 18. Now, you say that you made the first tank at the shop after 1906.

A. It was assembled. We bought the pipe. Practically it was standard pipe.

Q. 19. Now, tell us how you made that unsatisfactory machine that you made after 1906, as well as what you had to go by.

A. Mr. Jackson gave me some sketches to go by.

[fol. 255] Q. 20. What did you do then?

A. Completed his sketches and then ordered the materials for it.

Q. 21. The second tank that you mentioned, how did it resemble any of the figures on this drawing, Exhibit E?

A. It was something similar to No. 5. That is, it was not the same as that one either. It was about the same shape as No. 5. If I remember right, the opening came in from the side there. The pipe there shown coming in from the top came in from the side near the top. And there was an elbow at the bottom, and there was a pipe connected to that elbow.

Q. 22. For what?

A. For discharge.

The Court: What was the first one like?

The Witness: The first one was not like either of those sketches.

The Court: What was it like?

The Witness: It was a piece of flange pipe, cast iron pipe, about three and a half or four feet long, twelve inch pipe, with a flat cast iron flange on both the top and bottom.

By Mr. Cox:

Q. 23. And that you say was made under Mr. Jackson's instructions from his sketches?

A. Yes, sir.

Q. 24. Now, in this one that you say resembled Fig. 5, where was the inlet, or where was the air inlet in the tank?

A. The air inlet in the tank was in the side near the top.

[fol. 256] Q. 25. Anywhere else?

A. Not to my knowledge.

Q. 26. Can you say whether there was any bottom inlet or lower inlet for air?

A. I do not remember of any.

Q. 27. And that was what date, after 1906?

A. After 1906.

Cross-examination.

By Mr. Johnson:

X Q. 28. Mr. Clark, your chief duties, as I understood from you, were that of being Chief Draftsman for Mr. Jackson.

A. Not as Chief Draftsman, but I worked for the Bridge & Steel Works. Mr. Jackson was not around there very much at that time.

X Q. 29. Then I am afraid I do not get just exactly the connection you had with Mr. Jackson.

A. The Jackson Cordett Steel Works was a corporation engaged in steel construction work.

X Q. 30. And you were Chief Draftsman of that concern?

A. I was Chief Draftsman of that concern.

X Q. 31. And that was separate and distinct from the tunnel?

A. Yes.

X Q. 32. And your business was with the Steel Works?

A. My business was with the Bridge & Steel Works up until 1906.

X Q. 33. For whom were you Chief Engineer?

A. I worked for Mr. Fanning.

X Q. 34. The Mr. Fanning in the room who has previously testified?

A. John T. Fanning.

X Q. 35. Is it not true that Mr. Jackson got up different forms or devices that he tried out?

A. A great many of them, yes, sir.

[fol. 257] X Q. 36. And was it not his custom to try out a device before he had the drawings, elaborate drawings, made, so as to test the article that he wanted to see how it worked?

A. It was.

X Q. 37. So that when he had drawings, and had you make drawings, in 1906, following his usual procedure, he had tried out that device before he had you make the drawing?

A. No, the drawings I made at that time were pencil sketches.

X Q. 38. But it was customary for him to have a device made up and tested before he had any drawings made?

A. He usually made a model.

X Q. 39. He made a model and tried it out to see if it was practical?

A. Yes, sir.

X Q. 40. Your duties did not require you to go down into the tunnel, did they?

A. Very seldom, unless it was to take some measurements for some steel works.

X Q. 41. And that was very seldom that you went down?

A. It was very seldom I went down, yes, sir.

X Q. 42. You never saw any pneumatic concrete tamper employed in there?

A. No, sir.

X Q. 43. Nor did you ever see an electric shield operating in the tunnel?

A. We built up some steel shields for use in the tunnel.

X Q. 44. Horizontal shields?

A. Horizontal shields, and we also made a short section of steel sheeting that was used in certain sections of the tunnel.

X Q. 45. Are we both referring to horizontal shields?

A. We are both referring to horizontal shields.

[fol. 258] X Q. 46. Were they both Jackson's inventions?

A. I do not know that you would call them inventions?

X Q. 47. Were they electrically driven?

A. No, they were not electrically driven; they were jacked into place, as I remember.

X Q. 48. Did you ever see an automatic switch signal used in the tunnel?

A. I never saw it used in the tunnel; I saw it used in the plant.

X Q. 49. You believe it was later taken to the tunnel and tried out?

A. I could not say in regard to that; I could not remember.

X Q. 50. That was one of the things Jackson was working on?

A. As I remember it, it did not prove very satisfactory.

X Q. 51. It was tried out?

A. It was tried out.

X Q. 52. It was tried out in regard to the tunnel?

A. I could not say in regard to that.

X Q. 53. Was it not customary for him to try out the device wherever he was expecting to use it?

A. Wherever he happened to be at the time.

X Q. 54. Did he not give it a practical test wherever he was to use it?

A. If I remember, the machine was not satisfactory in the test he made at the plant.

DEFENDANT'S PROOFS CONTINUED

JOHN ERICSON, called as a witness on behalf of the defendants, having been duly sworn, testifies as follows:

Direct examination.

By Mr. Johnson:

Q. 1. Mr. Ericson, in your examination yesterday, more particularly Q. 15, you said that you had been City En-
[fol. 259] gineer for the last 30 years next spring?

A. Yes, sir.

Q. 2. Were there not gaps in your term as City Engineer?

A. No, sir, not in my rights as City Engineer. My duties were changed from 1919 to 1923. I was induced under duress to allow my title to be changed by the Corporation Counsel, who after I came back ruled that anybody that occupied that position under my title was a usurper, and I never lost time as a civil service man. I passed as a civil service man in 1898 as City Engineer, and nobody could take that right away from me except by trial and dismissal.

Q. 3. What I want to make clear, sir, is were there not intervals when you did not act as City Engineer in fact?

A. Yes, that is true.

Q. 4. When was that, sir?

A. It was, I think it was a short period from 1902 in the fall into the spring of 1903 when Mayor Harrison wanted me to act on the Board of Local Improvements for certain purposes for a short time, but I never relinquished my rights and title as City Engineer.

The Court: Do not talk about your rights and title. We want to know when you were on the job there and doing something so that you could observe these things.

The Witness: Then from 1919, on November 1st about until May, 1923, when I was acting as consulting engineer I was around the office from time to time, but I was not actually acting as City Engineer during that time.

[fol. 260] Q. 5. Who was on the job as City Engineer in fact during 1903 and 1904?

A. My first assistant. His name was John Spangler.

Cross-examination.

By Mr. Cox:

X Q. 6. What were you doing in 1903 and 1904, your actual duties?

A. I was a member of the Board of Public Improvements. That had particularly to do with street improvement work, but I visited the City Engineer's Office practically daily, but I was not acting really actually as City Engineer during that time; that was about six months.

X Q. 7. You kept track of the work in that office during that period?

A. Yes.

Redirect examination.

By Mr. Johnson:

R. D. Q. 8. You made no inspections during the period you were not in fact the City Engineer in 1903 and 1904?

A. I went along sometimes on some inspections but not like I used to do while I was in active service.

WILLIAM ARTINGSTALL recalled.

Direct examination.

By Mr. Johnson:

Q. 470. You heard the testimony given by witnesses for plaintiff, did you not?

A. Yes, sir.

[fol. 261] Q. 471. I call your attention to Plaintiff's Exhibit 15 dated Chicago, Illinois, January 23, 1904, and ask that in view of that written document, what date you would say you saw and conducted experiments with these different exhibits you have previously testified to, figures 4 and 2 of Exhibit E. Just about the dates.

A. The figure 2 would undoubtedly have been in 1904.

Cross-examination.

By Mr. Cox:

X Q. 472. How was the concrete or whatever it was mixed that was placed at 177 East Monroe Street in this machine shown in figure 1?

A. Well, it is my recollection as I pictured it before——

X Q. 473. How was it mixed before it was put in the machine, by a mixer?

A. No, just with a shovel.

JOHN T. FANNING recalled.

Direct examination.

By Mr. Johnson:

Q. 271. You have heard the testimony given by Plaintiff's witnesses in the last day, have you not?

A. I have.

Q. 272. I call your attention more particularly to the Plaintiff's Exhibit 15, dated January 23, 1904, and ask you what you have to say as to that exhibit in connection with the dates that you have given for the machines, such [fol. 262] as you built, figures 3, 4, and 5 of Exhibit I.

A. I would say I was possibly mistaken in my date.
Q. 273. What date was it then?
A. Not later than 1904.
Q. 274. Not later than 1904?
A. Yes.

Mr. Cox: No cross-examination.

JOHN J. KENNEDY, called as a witness on behalf of the defendants, being duly sworn, testified as follows:

Direct examination.

By Mr. Johnson:

Q. 1. Will you please give your name, age, residence and occupation?
A. John J. Kennedy; 59; 214 West 92nd Street; contractor.
Q. 2. Are you an officer of the Powers-Kennedy Contracting Corporation, one of the defendants in this suit?
A. Yes, sir.
Q. 3. What practical experience have you had with concrete and concrete construction?
A. Over 35 years.
Q. 4. Did you do some of the concrete work on one of the old subways?
A. Since 1900.
Q. 5. And what job is the Powers-Kennedy Contracting Corporation doing now?
A. Queensboro extension.
Q. 6. Are they using concrete there?
A. They are.
Q. 7. Who is in charge of this work?
A. I am.
[fol. 263] Q. 8. Do you use a concrete blower on that job?
A. We do.
Q. 9. In your own way I would like you to state as briefly as possible when you installed this concrete blower, how it operated, and if you had any trouble with it, and then any changes that you made in it. Tell the story just as you told it to me.

Mr. Cox: I do not see the materiality of this. It is perfectly evident to everyone that they have used the device of the patent, lock, stock and barrel, and the majority of the claims cover that device. If they have been able to do something with it that nobody else did, I do not think that it is material on the question of infringement.

Mr. Johnson: We show absolutely, sir, that we do not operate under the terms of the patent. We can not show this without the testimony of this witness.

The Court: Objection overruled.

Mr. Cox: You do not deny that you use the structure?

Mr. Johnson: Decidedly, we do.

A. We started concreting in the 42nd Street tunnel in December, 1922. I had made a lot of inquiries before we started about securing some method of putting concrete over the arch forms and in the side walls of the tunnels that would be different than any that had ever been used in New York to my knowledge.

I heard of several different ones. Among the number was this one that Mr. Flack was interested in. He came and saw [fol. 264] me and told me all about it. We decided to try it and he brought it over from the shop. We installed it in Park Avenue, and I think it was the day after Christmas, or two days after we started to blow——

Q. 10. What year?

A. 1922. When we first started with it I knew very little about blowing concrete with a machine. I had never used it before, but I knew enough about mechanics to know that if we had air pressure enough to raise the concrete we wanted, we would have to use in there as high as we needed to do it if we could find a scheme that we could use.

We installed this thing and the engineers in charge of the subway construction in New York have always been wedded to very dry concrete. They wanted it quite dry, so much so, that you would have to ram it. We tried to blow it to their satisfaction with this blower when we installed it, and we had a tremendous lot of trouble. I made some study of it, and found that the dry concrete would clog in the pipe. The friction on the side of the pipe——

Q. 11. Wait a minute. I show you two Court exhibits and ask if they correctly illustrate the structure and opera-

tion of the blower that you installed and have used in the subway extension that you have testified to.

A. The first one as it is shown there was not as we got it. The top pipes are not shown there.

Q. 12. No, they are cut out.

A. Outside of that it is what we are using today.

Mr. Johnson: I introduce in evidence the drawings just referred to.

[fol. 265] (Marked Defendants' Exhibits J and K.)

The Witness: K is perfect.

By the Court:

Q. 13. What does Exhibit K illustrate?

A. The discharge at the end of the line where the concrete comes up and blows through that opening.

By Mr. Johnson:

Q. 14. Will you please——

A. I have not gotten through with my answer.

(A. to Q. 10 repeated to the witness as far as it went.)

A. (continued). —and the weight of the concrete for the distance we had to blow it was too much for the pressure that we could apply. We could not get more than 80 pounds pressure.

Q. 15. Will you please come down and mark these parts as you talk?

A. 30 is the discharge pipe. When we had the dry concrete in the side of the tank, 31, the concrete came down in the discharge pipe, 30, and it was so heavy that before it would reach the line of discharge shown on this other figure, 32, the pipe would plug up. I did not understand at the time why it was, but we afterwards found that we had too much weight in there for the amount of pressure that could be applied from 33.

So I decided to try it with a liquid concrete. As it was, we could not use it to any advantage because it would take more time to take the pipes apart and make it so expensive [fol. 266] that we could not use it at all.

Then we increased the quantity of water we put in the mixture until we made a liquid concrete that would flow, and we cut out the top feed valve so that the pressure on the top of the mass was not pushed down too far.

Q. 16. Is this the top feed valve, No. 35 (indicating)?

A. Yes. Ever since then, when we opened the valve on the red line——

Q. 17. Valve 36?

A. Right. We found we had no trouble at all to blow the concrete. As a matter of illustration, in the discharge pipe from the bottom, I have had as high as fourteen 90-bends between the machine and the point of discharge at the other end.

Q. 18. 32?

A. 32. The reason we had to have so many 90's is that we were putting concrete in a very difficult heading and you could not run a straight line for any great distance.

With the liquid concrete I had no trouble with the bends. As a matter of fact, we blew the concrete for, I think, 1,160 feet and raised it vertically 67 feet above where we started, after the liquid concrete was being used. Previous to that when we had a straight line for 330 feet we could not blow the dry concrete with the machine at all. The pipes plugged up continuously.

By the Court:

Q. 19. Do I understand, Mr. Kennedy, that you used this dry concrete after you had made this change and taken out your top pipe?

A. No, your Honor, we could not.

[fol. 267] By Mr. Johnson:

Q. 20. You used wet concrete after that?

A. Yes, sir, it could flow.

By the Court:

Q. 21. So never with any device did you operate with a dry concrete?

A. I could not. It could not be done, I think, but that would be open to another mechanics question. But the pressure we had was only 80 pounds, and to raise concrete 60

feet, you would have to have an overcoming pressure on the other end that would blow the pipes all to pieces.

Q. 22. That is what you did, raised about 60 feet?

A. 60 to 67 feet. We only used the liquid concrete, though.

By Mr. Johnson:

Q. 23. How long did you attempt to use the dry concrete in the blower shown on Exhibit J, Fig. 2?

A. About 15 minutes after we started, maybe a half hour. The engineers of the Department here in the City are wedded to concrete quite dry. What I mean by dry concrete must be understood by concrete people that it is not really dry. It is a thick mass that is damp, that requires plugging and tamping a good deal. They did not want me to use a liquid concrete at all under any circumstances. As a matter of fact, I had to agree, in order to get a chance to use the machine for the blowing, I had to agree with the engineers that if the concrete would not hold up to the re-[fol. 268] quirements of the pressures of the City, that I would dig out that which I had already placed and put it in there to their satisfaction. With that arrangement they allowed me to go ahead.

They sent tubes to Columbia University to have them tested, and our liquid concrete, when it was set, showed a higher pressure than any they had done by any other contractor in the City. I believe I have the figures in the office.

So after that they permitted us to use liquid concrete right straight through.

Q. 24. After you shot some of this dry concrete and it plugged up in the discharge pipe on 30, what did you have to do to get it out?

A. Take the pipe apart, stand it on one end and hammer it clear.

The Court: What difference does that make, what he had to do afterwards?

Q. 25. So that you never used dry concrete in this device except as a trial?

A. A regular trial.

Q. 26. Would you recognize photographs of the actual machine blower that is on that job (handing photograph to the witness)?

A. Yes; I believe I was there when that photograph was taken.

Q. 27. These photographs are correct, Mr. Kennedy?

A. They are correct.

Mr. Johnson: I offer them in evidence.

(Marked Defendants' Exhibits L, M and N, respectively.)

Q. 28. When were these photographs taken?

A. I think it was last spring sometime.

[fol. 269] Q. 29. When this machine was first installed, Figs. 1 and 2 of Exhibit J, did they have connections for placing air under pressure above the mass in the container, 31?

A. They surely did, yes.

Q. 30. Did you use that at first or not?

A. We did.

Q. 31. For how long a period?

A. Very short. We found that it pressed the concrete down into the pipe too fast to discharge it, the pressure that we had, and we could not use it.

Q. 32. What did you do then?

A. Cut it off. We made the concrete liquid and then we did not have any trouble anymore.

Q. 33. But you did not use the top air after you used the liquid concrete?

A. No, sir. It is obvious that liquid concrete will flow down by itself without any pressure.

Q. 34. About when did you stop using the upper air, then?

A. My man is here that was on the machine. It would be hard for me to tell you exactly. But I do not think the top pipe stayed on there much more than 3 months after we started.

Q. 35. You mean you did not use it, but it stayed there?

A. That is right.

By the Court:

Q. 36. Did you have gravel or coarse stone in there?

A. Yes. The aggregates of the concrete we are using

is gravel not larger than will pass through an inch and a half ring, and it grades down from that to three-eighths of an inch, gravel, sand and cement.

[fol. 270] By Mr. Johnson:

Q. 37. What proportion, sir?

A. One cement, two sand, and 3.85 gravel.

Q. 38. Do you remember Mr. Morgan and myself going up and inspecting this device in the tunnel last spring?

A. Yes, sir.

Q. 39. And you stated that you used it without the upper air pressure?

A. Yes.

Q. 40. We asked you then why did you not actually cut out the pipe and disconnect it, do you remember that?

A. Well, it was a matter of neglect. It was left there. We did take it off.

Q. 41. You did take it off then, did you not?

A. Yes, sir.

Q. 42. And then you operated the blower in exactly the same manner that you had for several years?

A. Just the same. It was taken off, I think, before the photographs were made.

Q. 43. And these photographs show the blower actually blowing the wet concrete?

A. Absolutely, yes.

Q. 44. I call your attention more particularly to Exhibit N, to the discharge pipe, 30, and ask you how that concrete is coming out of that discharge pipe in that photograph?

A. It is apparent that it is liquid.

Q. 45. Is it coming in slugs?

A. Oh, no.

Q. 46. Or segments?

A. No.

Q. 47. Or wads?

A. No.

Q. 48. Will you mark it with the letter "C," please, the liquid that is coming out?

A. (Witness does as directed.)

Mr. Cox: I think we are wasting a lot of time with this. It is utterly immaterial.

[fol. 271] Q. 49. How would you say that concrete was forced out of this exit pipe, 30?

A. There is no air in the pipe, 30, when the concrete is dumped in from the hopper overhead. Consequently, the concrete goes right down through into the discharge pipe, as you can see. It fills the discharge pipe above the offset. The offset is that bend on the outside, 37. You fill it above that. When you open the valve, 36, on the red line, a current of air is blown through the pipe, through the discharge pipe, and the air will appear at the discharge before we get any concrete of any kind. It flows right straight through, it travels faster than the material, but it brings the material with it, and she starts to feed down, and immediately after we get any concrete, any out of the end of the pipe, the discharge end, it comes right along, the air and concrete all mix up together.

Where the discharge pipe enters into the form, it is above or away from the body of the concrete underneath and the air that blows the concrete through the pipe is discharged before it strikes the body of the concrete underneath, so that there is no possibility of making the concrete porous from the air that is used in the pipe to discharge the concrete.

Q. 50. In this last portion of your answer, are you now referring to Fig. 4 of Exhibit K?

A. Where the discharged concrete comes out of the line, yes.

Q. 51. The concrete does not come out of the end of the pipe?

A. Not in that case. We have had it come out of the end where we have blown the concrete in the roof arch of the tunnel.

[fol. 272] Q. 52. But in either case the air is permitted to escape?

A. Yes.

Q. 53. So that there is no porous concrete?

A. Yes, sir, that is right.

Q. 54. The end of this discharge pipe is plugged or closed, is it not?

A. It is. It is a fitting screwed on the end of the pipe.

Q. 55. And the concrete comes out of a slit in the side of the pipe?

A. Yes.

Q. 56. From your experience with handling concrete, how would you say, by what method that liquid concrete was forced through that pipe?

Mr. Cox: I object to that. That is mere loose guess work.

The Court: I will allow him to say what he thinks.

A. There is not any question in my mind now as to how it travels to the pipe. There is very little friction while the pressure is on, because the concrete and the air is in flight from the bottom of the machine to the point of discharge.

How I could prove that to you is that when we take the pipes apart, if it was sliding along on the pipe, the bottom of the pipe would wear out. I have, time without number, put my ear down on the pipe and my hands underneath, and you can hear it flying through without any greater friction in one pipe than in another.

As a matter of fact, the pipes that I have used nearly four years in discharging concrete from the blower I have sold to the second-hand man to be used elsewhere. If any concrete was floating along like dry concrete in the pipe, it [fol. 273] would rub on the bottom of the pipe and would wear the pipe out very shortly.

That was proven by the bends that we get, where even the liquid concrete in flight where it strikes a 90, it would have to go around a corner and the body of concrete in flight strikes against the bend, and one of those bends does not last much longer than a shift of eight hours.

So I designed a 90 of cast iron that was extraordinary heavy. We prepared for a patent on it. We have managed to use those 90's six months with the concrete going through continuously before they wear out. That is, where the concrete comes up, gives it a blow, turns its direction, and gives it another blow, while in the main line we have never had a hole in the main line pipe.

Q. 57. When you speak of the concrete being in flight in the discharge pipe, 30, exactly what do you mean by that; that it is floating on the air in that pipe?

A. Oh, yes, positively. The air and concrete is one mass that does not completely fill the pipe until it strikes the bend. Then the quantity of water and sand and cement

gathers there and it has to be lifted until the air blows through it again and takes it right around the next bend in flight without stopping. If it was dry it would plug.

Q. 58. You mean if it was not floating on the air it would plug?

Mr. Cox: I object to that. Counsel is trying to put words into the witness' mouth.

The Court: Go on.

[fol. 274] Q. 59. In these photographs, Mr. Kennedy, Exhibits L, M and N, the upper air connection is positively disconnected, is it not?

A. I am positive, yes.

Mr. Cox: Your Honor, I have made repeated requests and propounded repeated interrogatories, trying to learn something about this machine. I am going to ask that we be given the privilege of looking at these machines before we proceed with the cross examination of these witnesses who have prevented us from seeing the machine and now come in and testify as to its construction and operation.

Mr. Johnson: I have no objection to it, your Honor.

The Court: Can you arrange to go up this afternoon?

Mr. Johnson: Yes, sir.

Mr. Cox: You have three machines and one is operating?

The Witness: Yes.

(Adjourned to October 8th, 1926; at 10:30 A. M.)

JOHN J. KENNEDY resumed.

Direct examination.

By Mr. Johnson (continued):

Mr. Johnson: I want to show that after adjournment Mr. [fol. 275] Kennedy went up and showed us the operation of his device to show clearly by a short examination that there is no infringement; and if you will just permit him to state what was shown these other gentlemen at that time I think it will elucidate the situation.

The Court: All right, state it as quickly as you can.

Mr. Johnson: Yes.

Q. 60. Mr. Kennedy, did you after court adjourned yesterday let opposing counsel inspect your blower in operation?

A. I did.

Q. 61. While we were gathered at Forty-first Street and Broadway where you are excavating the subway, did you call my attention, and the attention of Mr. Cox, and the chief engineer, Mr. Kirkland, and Mr. Ray and other members of the party to several lengths of iron pipe extending along the gutter on Forty-first Street?

A. I did.

Q. 62. Now, in your own way please state what this pipe was, what it was used for, how long you had used it, where and why it was up in the street and not in the subway.

A. We started to buy pipe in 1922, and for about two years the work progressed beyond where the machine was and we had to buy more pipe as the line got longer. For about two years we bought pipe at different times, but we have bought no pipe that I have any knowledge of in the last two years, so that that pipe was in use that long at least. It might have been a part of the previous year so far as the pipe was concerned.

Now, that was the pipe used when you take the concrete [fol. 276] after it is discharged, the yellow pipe shown on the print.

Q. 63. That is exit pipe No. 30?

A. That is exit pipe No. 30, that is a part of pipe No. 30.

Q. 64. And a part of Exhibit J?

A. Between the blower and the discharge in the form where we were using the concrete.

I call your attention to it to note that there was not one side of the pipe that was worn more than the other. I thought there was some question in some of the gentlemen's minds as to what I had testified to, and I wanted to show them that the pipe, that the material was in flight rather than sliding along in the pipe.

Q. 65. Was the pipe appreciably worn at all?

A. Well, it was worn some. It was worn bright, of course, but it has been in use so long that it would be absolutely necessary to show where.

Q. 66. How long had it been used, did you say?

A. Well, at least two years. It is at least two years, I think, since I bought any pipe. Now, we have an overplus of pipe that we are taking out of the hole, and that is the reason it is on the street.

Q. 67. What do you do with it when you bring it on the street?

A. We sell it. I think we get thirty cents a foot for it right now.

Q. 68. Is the pipe junk or used again as pipe?

A. It is used again.

Q. 69. For pipe?

A. Yes, I paid 56 cents for it when I bought it.

Q. 70. Now, yesteday after you got your blower in operation, did you blow concrete into a form such as that shown in figure 4 of Exhibit K or not?

A. No, we did not blow it into a form.

[fol. 277] Q. 71. What did you blow it into yesterday?

A. Well, the point that we were placing the concrete was on the north side of the tunnel along the bank. The bank is on the north side of the street. and our pipe, our discharge pipe comes up out of the south side. In order to run the pipe over and discharge in the forms I would have to shut off the street traffic, and the cop on the corner will not let us do that, so we had to discharge it in a box on the south side of the street and load it in the wheel barrows or buggies and run it across the street.

Under ordinary circumstances, we would run the discharge pipe over to the form, and then it would run it just as shown on the print. The street traffic made it necessary to change there yesterday.

Q. 72. Well, the pipe the end of the exit pipe that you used yesterday had a cap on it?

A. Yes.

Q. 73. Like No. 50, did it not?

A. Yes, sir.

Q. 74. And the lower portion of the pipe was slotted like No. 51?

A. Yes, sir.

Q. 75. Of figure 4, was it not?

A. Yes, sir, that is a good picture.

Q. 76. Now, did you have any baffle plates or cover to prevent spattering?

A. We always do when we are out in the street where the traffic might be affected. They throw an old tin can or a piece of asphalt drum and slit the opening and slide it over the top to keep it from spattering on the public as they go past.

Q. 77. That is because the air pressure is so great coming out?

A. Yes, it would spatter surely.

[fol. 278] Q. 78. How did the concrete come out of exhibit pipe No. 30 yesterday into that box?

A. Well, as good an illustration as I could give you is that picture; it is about the same thing.

Q. 79. I hand you the photograph you refer to and ask you which one you mean (handing photograph to the witness).

A. That is it, your Honor.

The Court: That is the one you showed me yesterday.

Mr. Johnson: The witnesses refers to a photograph in Defendant's Exhibit N.

Q. 80. That is it came up like the liquid stream C that you marked in the photograph?

A. Yes.

Q. 81. Was any upper air pressure used in the blower yesterday while you were blowing?

A. Well, there is always some that would come up through the mass of concrete that is in the blower. It works up from the bottom. It was not discharged into the top at all.

Q. 82. What I mean now there was no air pressure from the air supply No. 55 into the top No. 56 of the blower, was there?

A. There was not.

Q. 83. That connection had been disconnected entirely last spring, I believe you stated?

A. Some time, I could not tell just when.

Q. 84. What pressure were you working with yesterday?

A. I think Joe told me it was 78. I asked him. 75 or 78.

Mr. Cox: Let the man who knows testify to that.

Q. 85. You were in there. You did not watch the gauge?

A. I did not. I asked the operator though what pressure he had.

[fol. 279] The Court: Is not that good enough?

The Witness: He told me 75 or 78, I am not sure.

The Court: Is not that good enough?

Mr. Cox: No, the pressure was 65 and dropped down to 45.

Mr. Johnson: I saw it 75 myself.

Mr. Cox: Yes, it went to 65 or 75 before it was turned on.

The Witness: Yes. What pressure I had was what he asked me.

Mr. Cox: He said 67 or 68.

The Witness: He asked me what pressure I had, and I understood that to mean what we had on the pressure.

Mr. Cox: 67 or 68 is what I understood him to say.

Mr. Johnson: I saw 75.

The Witness: Yes, I thought so. I asked him and he said 75 or 78, I am not sure which.

Q. 86. Is not that air blown up through the mass?

A. No doubt.

Q. 87. And would be indicated on the gauge No. 57?

A. No question.

Q. 88. That is simply the same as it operates back over above the mass in the chamber No. 31, is it not?

A. Yes, sir.

Q. 89. So that liquid concrete will flow out?

A. That liquid concrete would flow out whether there was any there or not, Mr. Johnson.

The Court: Did you have it on? I thought you did not have it on.

[fol. 280] Mr. Johnson: That is the very point I am trying to bring out, your Honor.

When the thing was set up originally, this connection ran all the way over.

The Court: I know, but you did not have it yesterday at the time.

Mr. Johnson: No, but the air bubbles up through that mass, and it is liquid just like water or slush.

The Court: That may be, but you had no pressure on it from the top.

Mr. Johnson: No, my question is probably not clear to your Honor. It is my own fault.

Mr. Cox: The witness says the pressure was established at the top by the air going up.

Mr. Johnson: It bubbles up in there. This vessel is closed. If something did not go up in there to fill up the space you would get a partial vacuum. That air just comes up and equalizes that partial vacuum.

Mr. Cox: And establishes equal pressure.

Q. 90. That pressure that works up through the liquid cement in chamber No. 31 does not serve to press the cement down into opening No. 58, does it?

Mr. Cox: I do not think this witness can testify to that. The pressure is there.

The Court: It is a matter of mechanics, I suppose. The effect of filling up that chamber would be to some extent to [fol. 281] reduce the pressure.

Mr. Johnson: It would be to hold it back, yes, sir; as the air boils up in there it kills the vacuum.

The Court: It kills the vacuum and also reduces the other pressure.

Mr. Johnson: No, because that mean pressure is here now. There will be an equalizing effect. It would equalize just like on an ejector.

Mr. Cox: The pressure is established in that at the beginning of the operation. That is the point I make.

Mr. Johnson: Oh, no.

The Court: Do not take this down.

(Discussion.)

Q. 91. Now, I just want to ask you about a sample of stone you used. These samples of stone that you employed in that blower.

A. Yes, that is a fair sample. We have a much smaller —a great majority of our stone is smaller than the larger ones.

Mr. Johnson: Is it necessary to put those in evidence?

The Court: I do not think so.

The Witness: A stone that will pass through an inch and a half screen.

Mr. Cox: Let it be noted on the record that they run from an inch to two inches.

The Witness: An inch stone passes through an inch and a half.

[fol. 282] Cross-examination.

By Mr. Cox:

X Q. 92. I believe you stated yesterday, Mr. Kennedy, that there was no wear on the pipes used for conveying the concrete, is that correct?

A. I did not get the question.

(X Q. 92 repeated.)

A. Oh, no, that is not correct. There certainly would have to be some wear.

X Q. 93. So your testimony is that there is some wear, that the pipes evidence some wear?

A. If I said there was no wear on the pipe, I did not mean it in that sense at all. Never. Certainly there is some wear.

X Q. 94. These pipes that you showed yesterday, were they pipes that had been used on different sections of the job at different times?

A. Right where we were there using them, Mr. Cox.

X Q. 95. Some of them had been disconnected?

A. Taken off and we were through with them.

X Q. 96. You were through with them. Some of them had been disconnected from one pipe line and put in another perhaps?

A. Several times.

X Q. 97. Now, you said that you had used these pipes from two to four years that you have there. About how many cubic yards have you placed with all the pipes?

Mr. Morgan: We object to that, your Honor.

Mr. Cox: It is to show how much use they had.

[fol. 283] The Court: Overruled. It is proper to explain it on cross examination. Go on.

A. That would be very difficult to tell, Mr. Cox. It would be anyway even to give you an approximate idea because we always have a mixer on the street that we use in different places around the top. It would be very hard for me to give you an idea of that because I could not tell you anyway.

X Q. 98. The wear upon the pipe depends on how much concrete has been shot through it, does it not?

A. I would say certainly.

X Q. 99. Now, I want you to give me some idea as to how much concrete you shot through all that pipe there.

A. It would be very hard for me to tell you that. I can not approximate it. Probably three thousand or four thousand yards. I could not tell you. You see, I would have to have some means of knowing the length of the tunnel, which I could get at the office, of course. The distance of the tunnel lining we have and multiply it by the concrete required in there. That could give it fairly well, but it would not be anywhere like what you are asking.

X Q. 100. Well then, you have shot as much as 157 yards a day there?

A. That is the biggest we ever did, yes.

X Q. 101. At that rate it would only take you at 157 yards a day about, say, 20 days in use?

A. That would be so if it was all ready. There are times we do not blow or use any concrete for probably a week.

X Q. 102. Then your estimate is at the rate of 157 yards a day that these machines have been used something like 20 days?

A. No, sir.

[fol. 284] X Q. 103. Well, then, you have only shot, according to your estimate, something like 3,000 yards?

A. 3,000 or 4,000 yards, I could not tell you that frankly. I would be glad to if I could. There are a certain number of yards in the whole job.

X Q. 104. That is how much? What would be the total yardage, about?

A. I think it is 6,000.

X Q. 105. The whole lining of the subway?

A. Yes, I think so.

X Q. 106. Can you not get any closer to it than that?

A. I could verify it for you in a minute. I think it is 66,000. I can tell you if you will let me call up.

X Q. 107. What did you say, 66,000?

A. I do not want to stand on that. I can not say.

X Q. 108. Your estimate is 66,000?

A. I will not estimate anything without calling up.

X Q. 109. Give us your best estimate. You are the man in charge of the job?

A. Yes, I am, and I am at a loss to tell you, frankly. I can call the office and get the figures just in a minute if you want them.

X Q. 110. Just give us your best estimate now and we will get the figures later if we need them.

A. I think it is 6,000. Really I think it is 6,000.

X Q. 111. 6,000?

A. Yes. I should very much like to call, because I am at a loss myself.

X Q. 112. That includes the floors and walls and the arch. How long is that subway?

A. It is 3600 feet.

X Q. 113. Just tell us how high and how wide it is.

A. Well, it is 13 feet, 2 inches, from the base of the rail to the inside lining of the arch; and it is about 17 feet, the tunnel was driven about 17 feet.

[fol. 285] X Q. 114. In width?

A. In height.

X Q. 115. In height. Now, the width.

A. The width, I think is 11 feet 2, or 3 inches. Inside driven about 13 feet.

X Q. 116. How thick is the concrete lining?

A. Well, we get paid for 18 inches running on the top. 15, I think it is, on the side.

X Q. 117. And the floor and bottom?

A. About 6 inches.

X Q. 118. Can you not figure up about how much that would be?

A. I can give you a very much faster and accurate amount by calling up.

X Q. 119. How much concrete would it take? Would it not be something over 40,000?

A. Possibly.

X Q. 120. You identified this article published, these articles published in the "Engineering News Record" and "The Compressed Air" magazines in answering interrogatories in this case, did you not?

A. I have not seen them, but I think they are the same. I was with the gentleman that wrote them, Mr. Smith.

X Q. 121. You gave him the material from which that was written?

A. Yes, we travelled through the subway, and I gave him everything.

X Q. 122. Do I understand you to say now that only a small part of the concrete was shot through these machines?

A. Oh, no, the greater part.

X Q. 123. The greater part?

A. Yes, indeed.

X Q. 124. More than half of it?

A. I think so, yes.

X Q. 125. Now, I want your best knowledge on the question of how long you used dry concrete there before you changed to wet.

A. Might I explain.

[fol. 286] X Q. 126. Yes, sure.

A. You know, when we started in, Mr. Cox, we had the blower set up about 300 feet from where we were discharging the concrete. The rise in the 300 feet is a little more than the height of the blower, possibly five feet, and the dry concrete that the engineers insisted on in the start plugged the pipes on me, so I could not do anything. I had to take them apart and clean them out. We hooked it up again and tried it again with the whole shift, but I do not think we were blowing dry concrete fifteen minutes until I wanted more water in it. We had some question with the engineers at the time about it, and they insisted it had to be drier than I wanted to blow it.

I was very anxious to use the blower and I knew we were going to have a great many difficult places where we could not blow through the straight line, as soon as I put 90 degree bends in it that would have to be put in the line. I told the engineers in charge there at the time, "if there was any question about the quality of the concrete that we put in because we have to make it liquid, why, we will have to take it out and I will not be able to use the blower because I could not blow it dry."

X Q. 127. Who was the engineer with whom you had this conversation?

A. Mr. Schmidts.

X Q. 128. What is his full name?

A. Mr. Mayer and Stephen Schmidts.

X Q. 129. Who is Mr. Mayer?

A. Mr. John H. Mayer.

X Q. 130. What is his position?

A. Division Engineer.

X Q. 131. Were they the engineers superintending the [fol. 287] job for the Transit Board?

A. Yes, they are still in charge.

X Q. 132. Well now, you have not told us how you started to use wet concrete. How long after?

A. The first day we blew it I used wet concrete, right direct the very first day.

X Q. 133. Did I understand you to say this day was shortly after Christmas, 1922?

A. Right.

X Q. 134. You shot wet concrete through it?

A. Yes.

X Q. 135. After you had tried dry?

A. That is what brought on the argument for using it at the time. They let me go and I understood right along I would have to take it out when they sent to Columbia University for tests, and so they had it tested, and the test showed up all right, and we never had to change it.

X Q. 136. Then you used the wet concrete right along?

A. Yes.

X Q. 137. As I understood you to say yesterday, that was about three months or so after that that you used wet concrete?

A. No, that I understood was in regard to that piece they talked about on the top.

Mr. Johnson: You are mistaken about that.

By Mr. Cox:

X Q. 138. They talked about three months or so after you started that you stopped using it?

Mr. Johnson: You are mistaken about that.

[fol. 288] By Mr. Cox:

X Q. 139. Then it was about three months or so after you stopped using the top air pipe, is that it?

A. I do not think it was that long. Joe was there first for sometime on there, and Mr. Fleck came in there.

X Q. 140. Well, it was approximately that time, two or three months, while Mr. Fleck was there operating it, and he used the top air pipe, did he not?

A. I think he did, but I would not be positive on that point.

X Q. 141. Now, what does your original specification call for, you have said it was a one, two, 3.85 mixture?

A. That is right.

X Q. 142. And how much water to the cubic yard or cubic foot?

A. The water was not specified so much as the mixture to be produced. They wanted it all about the consistency of porridge. It would stand up when you would throw it on the shovel. It would not slide off, and that would be very difficult for us.

X Q. 143. You have your specifications under which you have been working?

A. Yes.

X Q. 144. Can you let us see them?

A. Certainly.

X Q. 145. Have you got them here?

A. Oh, no, our specifications and contracts are all in one book, you know, and the bond and everything is in it, and that is safely put away.

X Q. 146. You will let us look at that, will you not?

A. Oh, yes, certainly.

X Q. 147. When you made this change to what you call wet, no change of the formula was agreed upon?

A. Why, there was not any change in the formula, only [fol. 289] that we would use a little more water.

X Q. 148. Did they not say how much?

A. No, they did not say how much, because they were not in favor of us using any more water.

X Q. 149. Well, was there not any correspondence or any writing of any kind between you and the Rapid Transit Commission or the engineers on that subject?

A. No, it was all done verbally, right on the job, in the hole.

X Q. 150. What is the correct title of the Board that has the supervision over this work?

A. The Board of Transportation.

X Q. 151. The Board of Transportation?

A. When we got the contract it was the old Transit Commission, the State of New York; and since then there has been a turn in politics, that changed the Board, and the Transit Commission now has charge of the traffic, while the Board of Transportation has charge of the construction of the subways and new lines.

X Q. 152. Who was the man on the Board who had supervision over these engineers that you have mentioned?

A. Well, they move up in steps, Mr. Cox, from the inspector to assistant engineer, and from assistant engineer to an assistant section engineer, and then section engineer, assistant division engineer, division engineer, and chief.

X Q. 153. On the job there between you and the Board who was the man?

A. Oh, yes, we never met the Board at all.

X Q. 154. One of these men you have mentioned was an inspector?

A. Oh, no, he was the section engineer in charge of the work in that section.

[fol. 290] X Q. 155. Now, you have mentioned Schmidts and Mayer.

A. Mayer was division engineer in charge of all the construction work in his division.

X Q. 156. Who was the inspector?

A. The inspector? We have had so many changes. Blessed if I can remember.

X Q. 157. Give us the name of the one who was on the job when you made this change in the concrete.

A. I think there were two or three of them on the different shifts, Mr. Cox. I can not remember who they were.

X Q. 158. Can you not give us the names of any of them?

A. I think I could find out for you. O'Brien was one of the. Eddy O'Brien, and Anderson. A fellow named Anderson was another. O'Brien has gone and Anderson is with an express company, I think. They are all gone.

X Q. 159. You will permit us to examine the records of, what is it, the Transportation Board?

A. The contract?

X Q. 160. The Transportation Board.

A. The Board of Transportation.

X Q. 161. The Board of Transportation, relating to the concrete work which you did on this job.

Mr. Johnson: You have no jurisdiction over that, I object to that.

By Mr. Cox:

X Q. 162. As far as you have anything to do with it you will agree to it.

[fol. 291] Mr. Johnson: You will have to ask the Board, it seems to me.

The Court: Overruled; answer.

A. I will bring it down for you, my contract.

X Q. 163. You will let us examine the records of the Board?

A. That is what you mean?

X Q. 164. You will tell the Board you have no objection, will you not?

A. I do not have to.

X Q. 165. You will do it?

A. I certainly will. I will bring you down the contract if you want it, if it is necessary.

X Q. 166. Who was the man, engineer or inspector, or man with whom you made this agreement about the change?

A. There was not any mention of an agreement about it, Mr. Cox, because they were very fixed in their opinion in favor of the dry concrete. I insisted that the concrete we were using was just as good as dry concrete, and they had no authority under our contract to say it was not until it would be tested. I put it in and agreed if it would not stand up I would have to take it out.

We waited then for the report of the test at Columbia, and when that came they permitted me to go right on, because the tests were better than the other.

X Q. 167. Your contract specified that there was to be a certain consistency in this concrete that was placed in the walls of that subway?

A. I do not think you will get much on that. I will bring it down.

X Q. 168. It had some description?

A. Oh, yes.

X Q. 169. Engineers are very careful to have the concrete specified, are they not?

A. Yes.

[fol. 292] X Q. 170. Dou you mean to say that these engineers or inspectors, without any writing or memorandum agreed to let you——

A. Try it out.

X Q. 171. To let you give them a wet concrete, wetter than what they wanted?

A. They would make me take it off. They would stop the job and hold up my bond. I had a million dollar bond on the job.

X Q. 172. They agreed to let you use wet concrete that was not in the original specification.

A. It was not needed in the original specification, as I understand it. I will bring you the specification.

X Q. 173. All right; I guess that is the best. You say that you agreed to take the concrete out if it was not satisfactory?

A. Yes, I would have to.

X Q. 174. With whom did you make that agreement?

A. With the engineer right in the field. I told Mr. Schmidts.

X Q. 175. Mr. Schmidts?

A. Yes.

X Q. 176. And who else?

A. I think I told Mr. Mayer at the time. I do not remember whether Mr. Mayer was there when I was talking to Mr. Schmidts or not.

X Q. 177. Do you know who had these tests made at Columbia?

A. That was a regular proceeding. They have done that right along.

X Q. 178. Who takes the samples?

A. The Board of Transportation engineers.

X Q. 179. Schmidts or Mayer?

A. No, they have a Testing Bureau. They send for it and the man comes there and he has a little form, and he comes down without you knowing it, like a bank examiner, and fills up these test forms and goes out with them.

[fol. 293] X Q. 180. Who was he?

A. Blessed if I know. I really do not think I would know the man. I do not know that I have seen him, although there have been tests made periodically, I think, as often as once a month.

X Q. 181. Yesterday when you started this machine the line plugged up, did it not?

A. It did, the first batch.

X Q. 182. It took about an hour and a half——

A. They had to take the pipe apart.

X Q. 183. And we stood around there about an hour and a half?

A. I was very sorry.

The Court: Get right down to earth.

Mr. Cox: This is something about the operation.

X Q. 184. Was that plug up any different from the plugs that you have described, when you first started in the end of 1922?

A. Plugging the pipe is plugging the pipe.

X Q. 185. A plug is a plug?

A. I will explain why that plug was, if you want it.

Mr. Johnson: Do that.

Mr. Cox: I will object to it, unless he shows he has knowledge.

The Witness: Yes, I know.

X Q. 186. This concrete as it comes out of the discharge pipe on your job, from this head or nozzle, or whatever it is? How does it look in the receptacle, or in the form, or in the box, or whatever it is deposited in?

A. It is like wet concrete, surely, stones, sand and cement. [fol. 294] X Q. 187. Is it quiet?

A. Oh, yes, a liquid mass.

X Q. 188. Just a liquid mass. Is there any bubbling or foaming in it?

A. Well, we have 4,600 feet of double tunnels built so far, Mr. Cox, and I do not think we have had two square feet of what you would call honeycomb. That is what you are getting to. Bubbles would make honeycomb, and we do not allow the air to get in the concrete where it is placed.

X Q. 189. When the concrete is discharged it is solid?

A. It is.

X Q. 190. It is solid?

A. Oh, yes, there is no question about it.

X Q. 191. It is not honeycombed?

A. No bubbles in it, none at all; it would be very dangerous to discharge it that way.

X Q. 192. I understand that you disconnected the pipe on this machine that we examined yesterday, last spring sometime?

A. I could not say just when, Mr. Cox. It did not make much difference, because the pipe was full of concrete.

X Q. 193. You disconnected it you say about in May, was it not, or in June?

A. On this particular machine?

X Q. 194. Yes. When you first substituted the present counsel, who were substituted for the former counsel, at that time?

A. No, I did not. I did not take it off of this machine at that time.

X Q. 195. When was that then?

A. The time when we took it off the other machines because our counsel was up there; I told our master mechanic to take the other ones off as well. We took that one off while they were there. I think they were right present and he went over and seen it was blocked up. There was no [fol. 295] possibility of any air going through. They neglected to take it off for some little time. Finally he took it off and it was cleaned up. Just what date, I could not tell you. It was of no consequence, so far as use was concerned, because the pipe was full of concrete.

X Q. 196. You were under contract to finish that job some long time ago, were you not, six months ago or so?

A. The 21st of April.

X Q. 197. The 21st of April, 1926?

A. Yes—no, the 29th. I think on the 29th of April.

X Q. 198. Was the concrete pretty well placed at that time?

A. Yes, sir, the majority of it was, yes.

X Q. 199. How much was left to be placed?

A. I could not tell you in yards.

X Q. 200. Can you not approximate it? Let us get some idea.

The Court: He said the majority of it. Why go beyond that?

A. That is the nearest I can get to it.

X Q. 201. It may have been nine-tenths, ninety per cent?

A. Those are details I can not memorize.

By the Court:

Q. 202. Was it most all of it?

A. The greater majority of it, yes; I think so, I could explain why we were not through if that is what you want.

[fol. 296] By Mr. Cox:

X Q. 203. No. In this operation that was made yesterday, how far down below the street level was the mixer?

A. The blower was about——

X Q. 204. I mean the placer, the gun or vessel?

A. About 55 feet below the street.

X Q. 205. About 55 feet below the street?

A. We had eight 90's in the line between the blower and the discharge.

X Q. 206. The eight ninety degree bends in the pipe?

A. And two forty-five's.

X Q. 207. And two forty-five's.

A. Yes.

X Q. 208. And then the pipe extended laterally to some extent from the gun up on its way up to the ground?

A. One joint.

X Q. 209. Do you know how much concrete was discharged in a batch?

A. Well, the actual figures are 2-1-2-385. That is one part cement, two parts sand——

X Q. 210. No; I mean what quantity of concrete was discharged. How many feet in a batch?

A. — in a batch?

X Q. 211. Yes. Yesterday. I am speaking of yesterday.

A. Well, the technical idea is about four feet, four or five feet, but I think we get a little more.

X Q. 212. You did not measure it then?

A. No. We measure the boxes, yes. There are three and eight-tenths cubic feet of stone placed in the mixer.

X Q. 213. You did not measure it yesterday; that is what I am bringing out?

A. Yes.

X Q. 214. How did you measure it?

A. There is a box up on top and the sand is drawn out, [fol. 297] just fills that, and that is the requirement for that box, and a little larger box for the stone.

X Q. 215. You were downstairs and if men upstairs did not put in that quantity, you would not know?

A. No. Personally I did not do it.

X Q. 216. That is what I mean.

A. I do not do it any time, as a matter of fact.

X Q. 217. Just one or two other things I want to clear up: This stuff that was discharged yesterday on the street, that was dumped in behind a wall of the subway, was it not?

A. Yes.

X Q. 218. To fill in the space?

A. No. The protection wall on the outside of the water proofing.

X Q. 218. First comes the wall of the subway and then the water proofing and this outside, and that was dumped on that outside wall?

A. Yes.

Redirect examination.

By Mr. Johnson:

R. D. Q. 219. Mr. Kennedy, why was the exit pipe 30 plugged up yesterday when you went up there?

Mr. Cox: I object to that, unless he knows of his own knowledge.

Mr. Johnson: The best of his own knowledge.

The Court: Objection overruled; go on.

A. My best judgment in the matter is all I can give you.

Mr. Cox: I object to his best judgment.

The Court: Go on.

[fol. 298] A. (Continuing:) The man who used it previously did not wash the pipe out when he got through,

and the drip that goes from the top of the line down to 90, or wherever it was, had set up and hardened and would not allow it to go through. That is a most unusual thing. I was very sorry when we got there that we had to wait until they cleaned it out, but I know just what the trouble was and I thought it was fair to everybody.

Mr. Cox: I object to that and move to strike it out. He is not stating anything on his best knowledge. Just his best judgment.

The Court: I will overrule your objection. He does not know it, but it seems a reasonable supposition.

Mr. Cox: At the beginning of his operations in 1922?

The Court: Yes.

R. D. Q. 220. You spoke, Mr. Kennedy, about 90's and 45's; those are bends in the pipes, I take it?

A. Yes, sir.

R. D. Q. 221. What is the relative wear between the pipe 30 and the 90's and 45's you have in it?

A. Well, the ordinary 90 standard fittings would wear out in about from one to two eight-hour shifts; and I designed the 90 and the 45 that I showed you up there yesterday, a big heavy cast iron thing; we got about six months out of them. They wear out because the whole force of the charge strikes the bend as it goes around, while through the pipe there is a great deal of concrete that goes through the pipe that does not touch it at all.

[fol. 299] R. D. Q. 222. I am not talking about your new 90's; I am talking about the old 90's and old form of the same thickness as this pipe 30. How long would they last?

A. We have had some of them last a couple of days and some of them would wear out in one day.

R. D. Q. 223. And these pipes you had up on the street there, parts of exit pipe 30, had been in use some two years or so, you would say?

A. Yes, at least. More than that.

Recross-examination.

By Mr. Cox:

R. X Q. 224. When you are shooting your concrete in this machine through the conduit, and the machine is shut

down for the night for any considerable period, is it your practice to wash it out?

A. Always. Very few times in the last few years that I know of that it was not washed out, or there would be somebody looking for a new job. We take off the end, fill the tank full of water, turn the air on, blow it right through, and fill it up again; two times. Blow the water up on top, wash it out as clean as it is possible to wash it, take all the cement out. No matter what time of day or night, those are strict orders always.

R. X Q. 225. Was it the practice with the man who operated the machine?

A. Those are his orders, Mr. Cox.

R. X Q. 226. Who usually operates the machine?

A. Well, I have got, I guess there are three or four of the boys can run it in good shape.

R. X Q. 227. Who is your best operator?

A. We have him here.

[fol. 300] R. X Q. 228. What is his name?

A. Joe Swartz. He was the first one.

R. X Q. 229. And he is the best operator you have?

A. I think so, yes. I do not know there is very much between him and Louis, the Italian, although Louis does not understand just as well.

R. X Q. 230. He is the man who operated it last night, Joe Swartz, is he not?

A. Yes. But he was not the man who operated it previous to last night.

R. X Q. 231. So he is not looking for a job.

Mr. Johnson: Another job, you mean?

R. X Q. 232. You are very strict to have that regulation followed, are you, about washing out the pipe when the man gets through?

A. Try very hard, Mr. Cox. You could see how serious it is with the whole gang waiting if we had to do that every time. You would have to do it if you do not wash it out.

R. X Q. 225. Do you use any gravel when you wash it out?

A. Nothing more than might have been in the gun or in the tank. We do not put any in.

R. X Q. 226. Just shoot water through?

A. Yes. Fill the tank and blow it through.

R. X Q. 227. And if you do not do that, there is concrete in the pipe that will set and clog it?

A. There is no question about that.

R. X Q. 228. And if a man neglects that, you would probably discharge him?

A. If I caught him at it, yes.

[fol. 301] JOSEPH L. SWARTZ, called as a witness on behalf of the defendants, being duly sworn, testifies as follows:

Direct examination.

By Mr. Johnson:

Q. 1. Will you please give your name, age, residence and occupation?

A. Joseph L. Swartz, 203 West 103rd Street; age 48; concrete foreman for the Powers Kennedy Contracting Corporation, 42nd Street.

Q. 2. I show you Plaintiff's Exhibit No. 3, and ask if the man shown in that enlarged cut, the man on the right, is yourself?

A. Yes, sir.

Q. 3. I show you photographs which are in evidence as Defendants' Exhibits L and M, and ask you if they are photographs of the blower that you operate?

A. Yes, sir.

Q. 4. Now, I show you Defendants' Exhibit N, and ask if that is the end of the exit pipe extending from that blower that you operate?

A. Yes, sir.

Q. 5. How long have you operated this concrete blower?

A. Since about April, 1923.

Q. 6. Are you familiar with drawings, sir?

A. A little.

Q. 7. Do you recognize this drawing, Defendants' Exhibit J, and drawing, Defendants' Exhibit K?

A. Yes, sir.

Q. 8. And you know enough about drawings to say that those are the same as these photographs (handing to the witness)?

A. Yes, sir.

Q. 9. Now, did you ever operate the blower so that air pressure was let in the blower above the concrete?

A. Yes, sir.

[fol. 302] Q. 10. When?

A. A few days after I started to run the machine.

Q. 11. A few days; how long?

A. About two or three days.

Q. 12. And then you stopped?

A. Yes, sir.

Q. 13. Have you ever done it since?

A. No, sir.

Q. 14. Why did you stop?

A. Oh, the pipe used to plug up all the time, and I got orders not to use that top valve.

Q. 15. The top connection having the valve, 35, was left on the machine, or not?

A. Yes, it was left on.

Q. 16. Is this valve, 35, the upper valve, the valve that would be to connect the pipe running into the chamber above the concrete?

A. Yes, sir.

Q. 17. And the valve 36 is what?

A. The bottom, the bottom valve.

Q. 18. And that valve does what?

A. It shoots the concrete out through the bottom of the machine.

Q. 19. By what?

A. Air.

Q. 20. That is, valve 36 is the one that lets the pressure of the air down through pipe 33, is that right?

A. Yes, sir.

Q. 21. I again show you these photographs, and more particularly photograph Defendants' Exhibit M, and ask you if that upper connection is shown connected or disconnected?

A. That is shown disconnected.

Q. 22. Do you know when that was positively disconnected like it is shown in that photograph?

A. I think it was last April. April, 1926.

Q. 23. Have you operated the blower, Defendants' Exhibit J, and that shown in these photographs, Defendants' [fol. 303] Exhibit- L, M and N, since April?

A. Yes, sir.

Q. 24. Was there any difference in operation with the upper air pipe absolutely cut out, than the operation was prior to that time, before you stopped using this valve, 35? Do you understand the question?

A. No, sir.

Q. 25. Well, I will withdraw that question and reword it.

Mr. Cox: Why not ask him to explain it?

Q. 26. Will you please look at Defendants' Exhibit J, and the pipe that I now mark 60; that is not connected with the chamber, 31, in any way is it?

A. No, sir.

Q. 27. That is like the photograph that you have in your hand, Defendants' Exhibit M, is it not?

A. Yes, sir.

Q. 28. If I understand your testimony correctly, after the first two or three days, you never used the upper air connection pipe, 60, and the upper valve, 35, is that right?

A. No, sir.

Q. 29. Was there any difference in blowing the concrete after last April or May when the pipe 60 was actually disconnected and cut off, from the chamber 31?

A. There was not any difference.

Q. 30. It operated just the same way?

A. Yes, sir.

Q. 31. Yesterday you operated the blower, did you not, when these gentlemen were all there?

A. Yes, sir.

Q. 32. Did you operate just the same as you had for the last—what is it, three years or so?

[fol. 304] A. Three years, over three years; operated the same way.

Q. 33. Absolutely the same way?

A. Yes, sir.

Q. 34. What air pressure did you have yesterday, sir, on the main line, and how would you indicate that pressure?

A. The gauge there.

Q. 35. Which one, sir?

A. I do not know what number it is.

Q. 36. This one (indicating)?

A. Yes.

Q. 37. 61?

A. Yes.

Q. 38. And what pressure did you have on that gauge, yesterday?

A. Well, it went from 60 one time to 68 and then it went to 75. I think 75 was the highest we had.

Q. 39. Did you have any other gauge on the machine yesterday?

A. Yes, sir.

Q. 40. Can you indicate it here?

A. Yes, sir.

Q. 41. Where is it?

A. On top of the tank.

Q. 42. The gauge is marked 57?

A. Yes, sir.

Q. 43. That connects with the inside of the chamber 31?

A. Yes, sir.

Q. 44. Will you describe in your own way just how these gauges work with this pipe, 60, absolutely disconnected as yesterday? I do not want any theory. I want to know what pressures were registered on these.

A. On the main line, at one time it was 68, and again it would be 75 pounds.

Q. 45. That would be shown on gauge, 61?

A. Yes, sir.

Q. 46. And how about at the same time gauge 57?

A. That was zero.

Q. 47. Would it stay at zero?

A. Until you put the concrete in the tank and turned your air on.

[fol. 305] Q. 48. And turned the air on. Through valve, 36?

A. Yes, sir.

Q. 49. Then what happened to gauge, 57?

A. Well, as soon as the air was turned on in the valve to release the air, the gauge pressure—the gauge on top of the tank would register about 30 pounds when the concrete was going out.

Q. 50. When the concrete was going out?

A. Yes, sir. And the other gauge would drop down to about 40 or 45, and then as long as I kept the valve on, it dropped down to about 32 pounds.

Q. 51. When you first turned on the lower valve, 36, in the main air line, what was this gauge, 57, registering?

A. Zero, when you first turned it on.

Q. 52. And at that time this gauge, 61, was registering in the neighborhood of——

A. From 68 to 75.

Q. 53. One of the gentlemen yesterday, Mr. Kirkland, asked to take off your gauge, 57, and put one of his own on, did he not?

A. Yes, sir.

Q. 54. And he did that, did he not?

A. Yes, sir.

Q. 55. Did this new gauge register just as you testified a minute ago, as to the other one?

A. Yes, sir.

Q. 56. You know, Mr. Kennedy's orders are always to wash out this blower after you are through with it and before stopping the operation, do you not?

A. Yes, sir.

Q. 57. Do you always do that?

A. Always.

Q. 58. Was that the reason of the stoppage yesterday?

A. Yes, sir.

Mr. Cox: Wait a minute. I object to that. Mr. Kennedy said he was not on the job the night before.

[fol. 306] Mr. Johnson: I am talking of this witness here.

Mr. Cox: Mr. Kennedy said this witness was not on the job the night before.

Q. 59. You always wash it out, do you not?

A. Yes, sir.

Cross-examination.

By Mr. Cox:

X Q. 60. Mr. Swartz, I want to clear up this point: As shown on this drawing, Defendants' Exhibit J, the gauge, 57, at the top of the tank, registered zero, as I understood you, before the air was turned on to the machine.

A. Yes, sir.

X Q. 61. And then as soon as the air was turned onto the machine, it shot up to about, you say, 30 pounds?

A. 30 pounds.

X Q. 62. Your old gauge you had on there was in pretty bad condition, was it not?

A. Yes.

X Q. 63. The glass was broken and the face was all smeared with set concrete?

A. Yes.

X Q. 64. And you could not read the figures on it, could you?

A. No.

X Q. 65. Do you know just what the condition of the job was about the time you cut off this top pipe?

A. Oh, yes.

X Q. 66. I mean last spring, when you cut off the top pipe, cut it off altogether as you stated?

A. What the condition of the job was?

X Q. 67. Yes. Were you nearly finished there?

A. There was quite a lot of work to do. I do not know much about that. I just had the operating of the machine, that is all. I have no idea how much of the job was to be done, or anything.

[fol. 307] X Q. 68. Do you know whether the arches, the top arches of the tunnel were all in?

A. Oh, no.

X Q. 69. The tunnel was practically finished was it not, clear over to Broadway?

A. Well, pretty near. There were a lot of arches to do yet.

X Q. 70. The sides or the top you mean?

A. Walls of the arches.

X Q. 71. Quite a lot of that arch work remaining to be done?

A. Yes, sir.

X Q. 72. Do you know how much?

A. I have not the least idea how much.

X Q. 73. It is all finished now, is it not?

A. All the concrete is not finished, no.

X Q. 74. The arches?

A. The arches are all in.

X Q. 75. You had three of these machines there?

A. Yes, sir.

X Q. 76. That is, you operate all three of them at times?

A. No—at times I did, yes.

X Q. 77. Do you know whether the top pipe was disconnected on the other two, the other two than the one that you operated yesterday?

A. They were on the other ones, yes, besides the one I operated yesterday.

X Q. 78. They were all three of them disconnected?

A. Two of them that I know of. The other one was out of commission altogether for a long while.

X Q. 79. You do not know about that?

A. No.

X Q. 80. When you disconnect a pipe like this pipe leading to 57, it is very apt to become filled with concrete or grout, is it not? The soup as you call it?

A. Oh, yes.

X Q. 81. And this pipe that you had on the machine that was operated yesterday extended some little distance be-
[fol. 308] yond the gauge, did it not?

A. Yes, sir.

X Q. 82. And outside of the gauge it had on it a valve with a long handle?

A. Yes, sir.

X Q. 83. And then there was a spout on the extreme end, turning down?

A. Yes, sir.

X Q. 84. That was an old coupling that had been left on the pipe, was it not?

A. That was a coupling to blow the air down.

X Q. 85. In this photograph here, enlargement, Plaintiff's Exhibit No. 3, will you please tell me where your left hand is and what that is on—your right hand, first, I want to ask?

A. The right hand, the bottom valve.

X Q. 86. And what is the left on?

A. The left hand is resting on a pipe, the upper pipe, the pipe for the upper part of the machine.

X Q. 87. Is not that left hand on the valve handle there?

A. No, I do not think so. It is just resting there so I can throw my hand here and close the door. Just lean up against it.

X Q. 88. You are quite sure that your left hand is not on the valve handle that operates the upper valve?

A. I do not think so. I am just resting my elbow on the pipe there, that is all.

X Q. 89. When did you pose for this photograph?

A. I do not know exactly. I have not the least idea.

X Q. 90. Well, now, just give us the approximate date. It is of some consequence.

A. Maybe a year or two ago. I could not exactly tell, because I did not even know it was coming out in the papers when I posed for it.

X Q. 91. Was it as much as two years ago?

A. Perhaps two years.

[fol. 309] X Q. 92. Not more than that?

A. I do not think so.

X Q. 93. Now, Mr. Swartz, are you interested in the Powers & Kennedy Company?

A. No, sir.

X Q. 94. Are you related to Powers or Kennedy?

A. My brother-in-law, that is all.

X Q. 95. Who is that?

A. Mr. Kennedy.

X Q. 96. Mr. Kennedy is your brother-in-law?

A. Yes.

Redirect examination.

By Mr. Johnson:

R. D. Q. 97. Mr. Swartz, you were asked about a relief valve that was on a machine up there yesterday; what is the purpose of that relief valve?

A. In case of a plug in the pipe, to release the air.

R. D. Q. 98. And in that particular machine yesterday it was on an extension of pipe, which I will designate 65, was it? Was that where it was?

A. Right off the gauge.

R. D. Q. 99. Up here (indicating)?

A. Running straight out from the gauge. That is it.

R. D. Q. 100. Right out here (indicating)?

A. Yes, sir.

R. D. Q. 101. I will dot a line there and we will call that—I am not much of a draftsman, but there was a relief valve at 65, right there, was there?

A. Yes, sir.

[fol. 310] FRANK L. DYER, called as a witness on behalf of the defendant, being first duly sworn, testifies as follows:

The Court: You need not bother about Mr. Dyer's qualifications. I think we can admit he is qualified. He is here in court all the time. I want to get through this testimony and find out any scientific matters to which he will testify.

Mr. Cox: I will admit his qualifications prima facie. I may want to ask him one or two questions, that is all.

Direct examination.

By Mr. Morgan:

Q. 1. State your name, age, residence, and occupation?

A. Frank L. Dyers; age, 56; residence, Montclair, New Jersey. I devote myself entirely to work as a patent expert.

Q. 2. Have you read the patent in suit and the testimony in the prior suit against the Ulen Contracting Company, and the decision of the presiding judge, Judge Hand, in this suit?

A. I have.

Q. 3. Please explain to the Court the substance of the original disclosure; please explain to the Court the substance of the original disclosure of the patent in suit as filed in the Patent Office, and then go on and say anything further about it that you have in mind.

A. As the application was originally filed, it related to apparatus for handling——

[fol. 311] The Court: I do not see how Mr. Dyer can be allowed to argue here about the file wrapper and everything else. That is not what we have experts here for.

Mr. Morgan: It is a rather complicated record.

The Court: You will have to argue that yourself. I am not going to take a record of that.

Q. 4. Mr. Dyer, please take up the patent in suit and explain its structure and manner of operation, as you understand it.

A. As I understand the invention of the patent in suit, the method involves the conveying of concrete by compressed air by detaching slugs or sub-masses of concrete from a mass in a closed chamber, and forcing these masses or slugs through the pipe to the place of delivery by pressure as distinguished from kinetic energy. That is the method and apparatus described in the patent and as already explained by Mr. Ray. The function of the lower air as disclosed in the patent is to break off the sub-masses of the concrete from the main mass within the receptacle and to force those sub-masses through the pipe by pressure.

By the Court:

Q. 5. You mean that pipe there (indicating)?

A. As shown in the patent; the lower air enters through the pipe 10 and opens just about the neck of the vessel. My understanding of the invention is that that lower air [fol. 312] breaks off successive masses of the concrete and forces them by pressure through the pipe.

The essential characteristics of the McMichael invention, as I understand it, is to preserve intact and undisturbed the complete mixture of the concrete batches in its travel from the compressed air device to the end of the conveying pipe.

By Mr. Morgan:

Q. 6. Do I understand from you that it is the function in this device of the pipe 8 to press the concrete downward?

A. The static pressure applied to the top of the mass by means of the pipe 8 forces the mass downwards so as to pass the mouth of the pipe of the lower air, permitting the lower air to detach the masses or slugs of concrete, as I have explained. The pipe 8 is a necessary feature of the apparatus and method.

By the Court:

Q. 7. Pipe 8 is the upper air?
A. Upper air.

The Court: Is that in all the claims here?
Mr. Cox: It is not in any of them, your Honor.
Mr. Morgan: I think it is in all of them, your Honor.
Mr. Johnson: Most of them.
Mr. Cox: That pipe is not mentioned. It simply says, means for admitting air to the upper part of the chamber. [fol. 313] Mr. Morgan: That contention is included in all of the claims; that is one of our contentions in this case.

By Mr. Morgan:

Q. 8. Mr. Dyer, will you please consider the patent in suit as it was explained by Mr. Kirkland and Mr. Ray in the preceding suit, and as construed by the present Court in the Ulen suit, and state your views on those different questions, if you differ from them?

Mr. Cox: May I add, there are several claims here in suit, claims to the apparatus, which do not mention any air at the top.
Mr. Morgan: That is a matter of difference of opinion of Counsel. I think it is a matter of argument.
Would you like to have the record here to refresh your memory, Mr. Dyer?
The Witness: I do not know as I quite understand your question.

(Q. 8 repeated.)

The Witness: I still do not get it. What question do you want me to consider?
The Court: I am not going to have any expert in this case, unless you can ask him some scientific question that is concrete. I am tired of this long diffusion. I am not going to change our rule and have an expert talking large about another lawsuit.
Mr. Morgan: Your Honor, I will take up the new patents [fol. 314] in the prior art, and have him explain them to the Court, and drop this other line entirely.

Q. 9. Will you please take up the prior patents set up in the answer, and explain them to the Court in relation to the issues of the present case?

A. I call your Honor's attention, first, to two patents to Smith, No. 122,497 and 122,498. The first patent relates to a very liquid concrete mixture designed to be used in manufacturing pavements, buildings, and so forth.

The second patent relates to apparatus for placing such a liquid mixture. I call your attention to figures 3 and 4. By figure 3 is shown a chamber in which the concrete materials are placed, and by means of a revolving fan or wheel, these ingredients are evidently mixed so as to form a liquid or easily and readily flowable material. From that mixing device the concrete flows into a chamber marked F in figure 4, and by means of compressed air admitted to that chamber, the liquid concrete mixture is forced out by pressure therein by kinetic effect through D in figure 1, so as to be deposited at the desired locality.

By the Court:

Q. 10. Is that it there (indicating)?

A. Yes, sir. It shows a very liquid mass, only the upper air pressure forcing the liquid there out through the pipe. I call your Honor's attention now to Patent to Beach, No. 267,318. In this patent an apparatus is shown for trans-
[fol. 315] porting the materials similar to grain. There is a closed chamber. Rather, there are two chambers, but they are operated alternately. In E the grain or other materials similar to grain, is placed and by means of pipe, air is admitted from an air reservoir, so as to apply pressure on top of the grain or material; that forces the grain down past the valve R into a conveying pipe H, and by means of the kinetic energy of the air rather than pressure the material is floated through that pipe to the place of deposit.

Beach is very similar indeed to the operation of the defendants' device here.

The next patent, which was not before your Honor before, is patent to Davidson, No. 599,055, where a very similar apparatus is shown for transporting tobacco leaves, tea leaves, wood chips, and so forth. Those are deposited in a hopper

shown at Fig. 6, and by means of a fan, A, shown in Fig. 1, the material is floated up by kinetic energy to the place of deposit.

Another patent which was not before your Honor, showing the state of the art, is Canniff, No. 873,345, shown particularly on sheet 1. This is a patent for handling grout, which is the very liquid mixture of cement and sand and water. The grout is placed in a container there shown in Fig. 2; the compressed air is then conducted by means of a pipe, B, and that compressed air flows down through pipe, B^1, into the chamber so as to agitate the mass and thoroughly mix it. After which the valve, B^1, is reversed so that air pressure then enters the top of the chamber to blow out the liquid grout mixture through a discharge pipe to the place of deposit.

[fol. 316] The final patent to which I refer, has been already treated, McIlvrid, No. 958,421, also showing a grout machine, where the grout mixture is placed in a closed container in which paddle wheels are located, so as to thoroughly mix it, after which compressed air enters the top of the container, so as to flow the mixture through a discharge pipe to the place of deposit.

(Adjourned to October 13th; at 10:30 A. M.)

JOHN KENNEDY recalled.

Direct examination.

By Mr. Johnson:

Q. 229. Mr. Kennedy, I want to clear up your testimony, any ambiguity that is in it. I call your attention to page 293 of the record:

"X Q. 189. When the concrete is discharged it is solid?
A. It is.
X Q. 190. It is solid?
A. Oh, yes, there is no question about it.
X Q. 191. It is not honeycombed?
A. No bubbles in it, none at all; it would be very dangerous to discharge it that way."

What have you to say as to that testimony? Is that correct or not?

A. It is ambiguous.

[fol. 317] Q. 230. Just tell the facts.

A. The concrete as discharged from the pipe is in a liquid condition. When it goes into the form, it is in a liquid condition. It solidifies in the form.

FRANK L. DYER resumed.

Direct examination.

By Mr. Morgan (continued):

Mr. Morgan: I have here, your Honor, an enlarged photographic copy of the drawing of the Smith Patent 122,498, which patent is in evidence, and I would like to introduce this merely for the convenience of the Court.

The Court: All right.

(Marked Defendants' Exhibit O.)

Q. 11. Mr. Dyer, in this Smith Patent No. 122,498, please state what means, if any, are shown for closing off the mixer from the concrete blower during the blowing of the concrete?

A. The gate value, Your Honor, is shown in the duct *d*, to prevent the air pressure from blowing the concrete back from the blower.

Q. 12. I suggest that you mark that with, say, the letter G for identification.

A. I have done so.

Q. 13. Mr. Dyer, have you examined the defendants' device and seen it in operation?

A. Yes. I saw the defendants' device in operation in [fol. 318] April of this year at the Forty-second Street subway. At that time it was discharging through a horizontal length of about 400 feet with one rise of about ten or fifteen feet to the point of discharge.

Q. 14. I hand you herewith Defendants' Exhibits L, M and N, being photographs of Defendants' device, and ask if you were present when those photographs were taken.

A. Yes, I was.

Q. 15. Please state whether or not at that time the top air pipe was disconnected.

A. It was.

Q. 16. Will you please explain to the Court the structure and manner of operation of defendants' device, referring as you may see fit to Defendants' Exhibit J and K.

A. The defendants' device comprises a blower of the general hopper shape shown, a door being provided in the upper part through which the very liquid concrete mixture is introduced into the blower, after which the door is closed so as to seal the interior of the blower.

Leading into the lower end of the blower is a discharge pipe as shown in yellow in the exhibit before your Honor and marked 30. The pipe leads to the place of discharge and through it the very wet concrete is directed to the desired forms or molds.

Entering the pipe 30 below the blower is a pipe supplying air. This pipe leads from a suitable air tank or reservoir not shown in this drawing, and at the time the apparatus was operated under the conditions I observed then, the air pressure was about 60 pounds. Of course, the pressure will [fol. 319] have to be increased if the discharge has to be forced through a large number of bends or through a vertical extension, as I understand is now being done in the particular work with which the blower is used.

By means of a valve marked 36, air can be introduced through the air pipe 33 and will pass through the discharge pipe 30. If we discharge the concrete in the blower, and consider this air passing through that pipe, we will find that the energy of the air is both static and kinetic. The air has a certain static pressure which gradually drops as it progresses through the pipe, being at the maximum in the neighborhood of the blower and the minimum at the discharge orifice, and its velocity depends upon a number of factors, including the initial pressure, the diameter of the pipe, the length of the pipe and so forth.

In addition to the static pressure of the air, it also has a small added pressure called pressure of impact. If, for example, I should place a tube at right angles at the pipe 30, as I indicate with my pencil, and connect a gauge at the upper end of that tube, a certain pressure will be indicated at different points along the pipe, and that pressure will be the static pressure.

If, however, I take the same tube and bring it down inside the pipe and put a right angled bend at the lower end of the tube facing the direction of the flow, the pressure will be slightly greater because that tube known as a pitot tube will indicate both the static pressure as well as the kinetic pressure or impact pressure.

The kinetic energy of the air operates cumulatively. In other words, with a steam turbine, we have very large rotors [fol. 320] that may weigh 100 tons, and we direct against that rotor a jet of steam. The only energy we have in that steam is the kinetic energy of that impact. It is very small measured in pressure, but it is operating all the time, and the cumulative effect is to drive the rotor and in that way secure power.

When we introduce the liquid concrete, and the concrete that I saw was very liquid, about like pea soup, in the blower and turn on the air, this column of air begins to travel through the pipe and the static pressure of that air causes a certain pressure to be established above the concrete mass.

In other words, the air bubbles up through the mass and breaks the vacuum above the concrete mass in the blower. That air pressure above the mass necessarily is always lower than the pressure below, because in addition to the weight of the concrete opposing the air as it flows out, we have the resistance to the passage of the air by reason of the material itself. So that the pressure above is always considerably less than the pressure below.

That, however, allows the liquid concrete to flow out through the blower where it is caught by this traveling current of air and carried along the pipe in suspension.

I observed at the time that I saw the apparatus, that whenever the air was turned on, there was a tremendous noise like the inside of a boiler factory by reason of the fact that the stones in the concrete mass are being bumped along the pipe; they rattle along the pipe. If the mass came [fol. 321] out in a gob or a sub-mass, that noise would not be heard.

The discharge as I saw it was directed horizontally and the concrete was being discharged into forms, as shown in figure 4, Exhibit K, the impact of the material striking the end of the pipe and the material then dropping by gravity into the forms.

I observed that when the discharge was first made, we got nothing but air, and then following was a discharge of sand and cement, light stuff, light soup-like stuff, and then after that, the stones came along, because, being heavier, they naturally had more inertia and held back and that very wet concrete then simply dropped in the molds and would set.

That operation is not, to my mind, the same as the operation of the patent in suit because we did not have a compressor above the mass, because necessarily any pressure above the mass is less than the pressure below there, because the origin of the pressure above the mass is form below. Nor did we have the breaking off of the concrete mass into sub-masses or slugs, but we had the concrete carried through in a steady stream by the kinetic energy.

The operation as I saw it was very much slower than I understand to be the operation testified to in the Ulen case. As I remember it, the testimony showed that the McMichael blower discharged in five or ten seconds. The discharge in the defendants' device was about 50 seconds.

[fol. 322] By the Court:

Q. 17. All you want in the way of pressure above in any kind of device, whether it is the plaintiff's or defendants' here, is enough pressure to empty the receptacle, is it not?

A. With the McMichael patent, the patent says that the material is impervious to air. Therefore, you could not introduce air at the bottom and you must have pressure at the top sufficiently great to actually force the material out. It flows out by gravity.

Q. 18. Supposing there was no pressure at all?

A. Where, your Honor?

Q. 19. Would it be possible to have no pressure at all? Would the material flow down without any air bubbles going up?

A. If you have air below and if you have a liquid material, the air will go out. If you do not have air pressure below and have a liquid material, it will flow.

I might say that when I was with Edison out at the Edison laboratory, he was working on his so-called cement house, and that house was a poured house. He used very little cement or very little concrete, but he did not use a

thing of this kind. He simply used chutes. But he poured that concrete down in vertical forms, and then it would flow over into horizontal forms to form the floors.

If that is what your Honor has asked me, liquid concrete would flow.

Q. 20. I was asking you whether if you had a thick material, if it was not as liquid, if it was pretty thin, but thick [fol. 323] enough to flow under pressure, at any rate, from above, would it flow if that pressure was withdrawn?

A. I doubt it because there always would be a tendency, if the concrete is thick, to bridge across the lower end of the hopper, and as a matter of fact, with the McMichael patent, as your Honor may remember, the lower air jet is placed at that point.

Q. 21. The pressure above we call simply a booster, do we?

A. No, we call the thing a booster. The McMichael idea is to force the concrete out by means of the upper air pressure and the lower air pressure was simply the booster or auxiliary supply.

Mr. Cox: We have here the drawing identified by this witness Fleck who built the machine introduced as Plaintiff's Exhibit 5. There is some deviation between that exhibit and this Exhibit J.

Mr. Morgan: I will say that I sent my draftsman up there unaccompanied by me and told him to make this drawing showing exactly the machine which was in place. If Mr. Cox is going to make an evidential point of this, I will have to send for my draftsman and put him on the stand and have him testify as to that.

Mr. Cox: If there is any difference between this authentic drawing that has been identified by Mr. Fleck and that drawing, I simply want to note it.

The Court: Go on.

[fol. 324] By Mr. Morgan:

Q. 21. Mr. Dyer, will you please state whether or not the liquid concrete is carried through the discharge pipe kinetically or by the flotation method?

A. It is, as I tried to explain it, nothing but static pressure.

Mr. Cox: If there is any difference, this drawing identified by the defendant Fleck must control. The proportions, I think, are different.

Mr. Morgan: I ask permission, therefore, your Honor, in view of opposing counsel's raising this question to put my draftsman on.

The Court: Is he here?

Mr. Morgan: He is down at my office.

Mr. Cox: He can not contradict his own defendant.

The Court: Do these things make any difference?

Mr. Cox: I do not know; they may or they may not.

The Court: If I were in your place, before I raised the point, I think I would know whether it was of any avail.

Mr. Cox: I have not had a chance to talk to my expert on this matter. I think there is some difference because the proportion of this discharge pipe to the discharge orifice at the bottom of the vessel and the air inlet is different.

The Court: Go on.

[fol. 325] Cross-examination.

By Mr. Cox:

X Q. 22. Mr. Dyer, these photographs, L, M and N in evidence, were flash lights, were they not?

A. Yes.

X Q. 23. Do you know what exposure was employed? *A.* The shutter of the camera was opened and the flash light then set off, I suppose?

A. Yes.

X Q. 24. You did not see the operation of the defendants' apparatus on October 7th at Forty-first Street and Broadw-y?

A. I did not.

X Q. 25. You have stated this morning that there was a certain velocity of air in the outlet marked 58 of the drawing, Exhibit J. Did you ascertain what that velocity was?

A. I did not.

X Q. 26. Were you able in any way to judge the velocity?

A. No, except that it was sufficient to carry the material out.

X Q. 27. You have called the defendants' apparatus a blower. Do you know what pressures are ordinarily employed in blowers?

Mr. Morgan: I object, your Honor. What kind of blowers? What kind of pressures?

The Court: I will allow the question.

A. Some blowers using fans may have a pressure of only a fraction of an ounce to several ounces. Blowers of the Root type give substantial pressures that can be measured in pounds.

I did not use the word "blower" as having any significance at all. You might call it a gun. I think it is called a gun, practically.

[fol. 326] X Q. 27. Did you employ any means to ascertain the pressure in the outlet pipe 58 and 30?

A. No, except that that pressure was necessarily higher than the pressure indicated on the gauge at the top of the blower.

X Q. 28. Then you think that the pressure in the discharge pipe marked variously 30 and 58, is greater than the pressure at the top of the vessel?

A. Yes, necessarily so.

X Q. 29. You did not ascertain that by means of any instrument?

A. No, except that the origin of the pressure is below and therefore it must be less than above. I have, however, in other arts dealing with somewhat the same situation made measurements that convinced me of the correctness of my statement.

X Q. 30. Did you form any opinion as to how great the difference is between the bottom and the top of the vessel, the discharge outlet and the top?

A. Simply as a matter of opinion, I have.

X Q. 31. You have not measured it in any way?

A. No.

X Q. 32. You stated that if the concrete were being discharged in slugs, the noise that you observed in the pipe would not occur. Why do you say that?

A. Because as I understand the invention, as it was explained by Mr. Ray, there are sub-masses of the material forced through the pipe in their original conditions of mix, just like the section of a small piece of putty that we used to put in pea-shooters as boys and blow through the pressure. That slug would, therefore, be in the nature of a [fol. 327] plug. It would be going through the pipe like

the receptacle of a pneumatic piston that is forced below by the static pressure through the pipe, and being a soft more or less duplicated material, I should not expect that there would be much noise.

But the noise I heard was like gravel on a tin roof being blown by a heavy storm, except to a very exaggerated extent. It was a very simple noise if you could visualize these rocks or stones rattling through the pipe.

X Q. 33. Concrete being composed of rock or gravel mixed in with soft wet material, can you not conceive that there would be internal agitation in each batch or each slug?

A. Not if the device worked with static pressure, as I understand to be the case, that is, the McMichael, of course.

X Q. 34. What caused the noises that you heard? Was not that caused by the lateral movement of the stones?

A. Yes, they were rattling along, they were being carried along by the air just like a dust storm on the street, and they rattled back and forth.

X Q. 35. There was lateral movement of the stone as it passed through the pipe?

A. Yes.

X Q. 36. That is to say, across the pipe?

A. Yes.

By the Court:

Q. 37. Why would that occur ~~any~~ more if the stones were being carried along like dust, as you said, or sand, than if it was being forced through?

A. If you force a mass through, a mass of cement with [fol. 328] sand and stone all glob together like a plug and force something through, which I understand to be what McMichael claims, and that thing goes through as a unit, the mass would not change its composition. It would go through like the piston of a gas engine.

Q. 38. I should think it might make a great deal of noise of rattling or scraping.

A. Not through the pipe.

Q. 39. With these rough edges of gravel an inch and a half in diameter, I do not see why not.

A. Of course, rough edges of stone would make a scratching noise, but not the rattling noise that I observed in the pipe.

By Mr. Cox:

X Q. 40. Can you not conceive of those slugs being in rotation as they move along and turning over internally?

A. Not if you work it with pressure.

X Q. 41. Did you not hear the testimony of Mr. Kirkland in which he said that there was internal mixing of the slugs as they went along?

A. I did not. Did Mr. Kirkland testify in this case?

X Q. 42. Yes.

A. I do not think I heard him.

Mr. Morgan: He did not testify in this case.

Mr. Cox: Yes, he testified for the defendant relating to an operation described by him.

[fol. 329] By Mr. Cox:

X Q. 43. I just want to consider a few things: You know the weight of a cubic foot of concrete, do you not?

A. Not offhand, no.

X Q. 44. About what is it?

A. I have not any idea. I would not like to guess. The books tell you.

X Q. 45. What is your idea? I want to know that as affecting your testimony as to its operation?

A. I would not like to guess, Mr. Cox.

X Q. 46. You have not any definite opinion as to its weight?

A. No; several hundred pounds, I should say.

X Q. 47. Can you tell us the relative weight of air and stone, say granite or limestone or flint?

A. No; the books will tell you that.

X Q. 48. Can you give us the relative weight of air and water, which is the basic unit in determining the specific gravity of solids?

A. Water, of course, is one, air must be .1 or less—I do not carry those figures in my head.

X Q. 49. So air would be 1/10?

A. One-one-hundredth; .01.

X Q. 50. As a matter of fact, do you not remember learning somewhere that the weight of air is about one-eight-hundreth of the weight of water?

A. That may very well be.

X Q. 51. So that water is eight hundred times heavier than air and ordinary rock is from two and a half to three times heavier than water?

A. I accept those statements.

X Q. 52. So that rock is from 2,400 to 3,000 times as heavy as air?

[fol. 330] A. That may very well be.

X Q. 53. And after considering these weights, you are still of the opinion that the air in defendants' apparatus can pick up and float to distances of 1,100 feet or more and to elevations up to 67 feet, rock which is 2,400 to 3,000 times heavier?

A. Absolutely.

X Q. 54. That is your opinion?

A. Yes.

X Q. 55. Are you familiar with the operation of what is commonly known as an air lift?

A. Water lift?

X Q. 56. An air lift for water?

A. Yes. I know generally, Mr. Cox. I would not care to go into the details of that. I know what an air lift is. It raises water from deep wells by means of air pressure travelling up through the pipe.

X Q. 57. Do you know how the water comes up to the top of the pipe when that air lift is operating?

A. I do not recall that, no. Of course, Mr. Cox, I have tried to emphasize that the reason air is effective is because it is cumulative.

X Q. 58. I understand your direct testimony. Mr. Dyer, you are not an engineer, are you?

A. No, though I spent ten years of my life in the Edison Laboratories.

X Q. 59. Have you had any experience in the actual operation of apparatus employing fluids under pressure?

A. I made experiments with apparatus of that kind.

X Q. 60. I mean in the actual operation of the apparatus?

A. I have actually operated apparatus involving moving fluids under pressure.

[fol. 331] X Q. 61. Just state briefly what that was.

A. One was a case of so-called automobile torpedo. A test was made of the gases for operating the turbines in the torpedo. The other was a case in this district involving

acetylene lamps where the gas had to pass through a sludge-like material somewhat with the consistency of concrete.

X Q. 62. The air passed through calcium carbide, forming acetylene gas?

A. The gas as developed had to pass through calcium carbide.

Mr. Morgan: I have the draftsman here, your Honor.

The Court: Put him on.

HAROLD I. HARTSHORNE, called as a witness on behalf of the defendants, being first duly sworn, testifies as follows:

Direct examination.

By Mr. Morgan:

Q. 1. Please state your name, age, residence and occupation?

A. Harold I. Hartshorne; thirty years old; Murray Hill, New Jersey; draftsman.

Q. 2. Can you tell me who made this drawing, Defendants' Exhibit J, which is before you?

A. I did.

Q. 3. Will you please state briefly how you made that drawing what measurements and observations you made and what sources you used?

A. I first went up and looked at the machine and after I [fol. 332] returned I was given a blueprint which Mr. Morgan holds (Plaintiff's Exhibit No. 4). I think I was given the blueprint first and took it up with me and looked at the machine, checked it up, came back to the office and laid my drawing out in proportion to the blueprint, with corrections as noted on the actual machine.

Cross-examination.

By Mr. Cox:

X Q. 4. Mr. Hartshorne, when you measured this machine shown in drawing, Exhibit J, was the machine in operation?

A. No.

X Q. 5. Was it hooked up ready for operation?

A. It was hooked up ready for operation.

X Q. 6. And the bottom outlet which is marked 58 on your drawing was connected with the tank; is that right?

A. Yes, it was.

X Q. 7. And the pipe marked 33 was connected with the bottom outlet?

A. Yes.

X Q. 8. And you have identified this drawing—this is the drawing you identified (Referring to Exhibit 4)?

A. Yes.

X Q. 9. Is that the only drawing that you had to guide you?

A. Yes, to my memory.

X Q. 10. Did you make any measurements of the machine up there?

A. Only by eye.

X Q. 11. You did not make any actual measurements with any instrument?

A. No.

X Q. 12. You did not have, then, Exhibit 5 which I now show you?

A. I cannot state definitely on that.

Mr. Morgan: We rest.

[fol. 333] REBUTTAL PROOFS (CONTINUED)

FREDERICK RAY, called as a witness in behalf of the plaintiff in rebuttal, being duly sworn, testifies as follows:

Direct examination.

By Mr. Cox:

Mr. Cox: I suppose Mr. Ray's qualifications will be admitted?

Mr. Morgan: They are admitted.

Q. 1. I will just ask you Mr. Ray to state what actual practical experience you have had in the construction and operation of apparatus operating with fluids under pressure.

A. I have spent a large part of my engineering work along those lines in connection with pumping machinery,

air machinery of various kinds as well as with steam turbines and such things. Most of my work has been in connection with the handling of liquids and gases.

Q. 2. Have you examined different apparatus for discharging and conveying and placing concrete pneumatically?

A. Yes, I have, several.

Q. 3. Did you witness the operation and study the construction and operation of the defendants' apparatus at 41st Street and Broadway, Queensborough Subway extension, on October 7th?

A. I did.

Q. 4. I am referring to the machine as operated by Mr. Swartz in the presence of Mr. Kennedy and a number of witnesses?

A. Yes, I was there.

[fol. 334] Q. 5. You have also heard the testimony of the defendant's witnesses concerning the construction and operation of that apparatus and have examined the exhibits which have been introduced in evidence, have you?

A. I have.

Q. 6. Please explain the construction and operation of defendants' machine as shown by the exhibits and as observed by you at the exhibition of the machine in operation on October 7th at the Queensborough Subway extension, 41st Street and Broadway, and state whether you agree with the description of defendants' witnesses?

A. I will first refer to that enlarged drawing, Plaintiff's Exhibit 3, which is a reproduction of the Engineering article describing the defendants' apparatus as originally installed, and as shown in this photograph, the apparatus consists of a receiver B containing the charge of concrete which is conducted into the receiver through the chute H above and into a hopper going then through a valve located at A and finally into the receiver itself.

After the charge is placed in the receiver, the valve located near A is closed by means of a pneumatic cylinder, and air may be admitted first to the bottom of the discharge pipe at A by manipulating the throttle valve K, and then air may be admitted to the top of the receiver by manipulating the throttle valve M, or this mode of procedure may be reversed, admitting the air to the top of the

receiver first and then immediately to the discharge pipe E afterwards.

If this mode of operation, either one of them which I have outlined, is carried on, then the apparatus, in my opin-
[fol. 335] ion, will operate exactly the same as the device of the McMichael patent in suit; that is, the concrete will be discharged through the discharge pipe in the form of slugs or pistons of various sizes, with a slug or a certain amount of air between these various pistons, the whole operation being due to the pressure of the air and in no way due to its velocity or kinetic effect.

The defendants' machine, as observed it, had the top of the air pipe marked A' in this photograph disconnected so that it was impossible to admit air directly to the top of the concrete receiver, so that in operating, the concrete was simply placed in the receiver and the inlet valve closed, and then the operator opened the throttle valve K, admitting air to the discharge pipe at E.

There was a gauge located on the main air supply represented by O in this photograph, and there was another guage attached to the top of the concrete receiver indicated by P in this photograph. When the throttle valve K was closed, the air pressure in the air line was from 65 to 75 pounds. It varied at different times slightly.

Immediately, when the throttle valve K was opened, the air in this line dropped to about 45 pounds or something like that, 40 or 45 pounds, in that neighborhood.

The gauge on the receiver, on the top of the receiver, indicated some pressure, that is the particular gauge that was being used on the machine. It was impossible, how-
[fol. 336] ever, to show what this pressure was, so a new gauge was brought up by Mr. Kirkman which was later attached to the machine at this point and this gauge would jump up to about 30 pounds immediately that the throttle valve K was opened.

They would both then gradually drop off, as the charge was discharged from the receiver, the gauge at the top of the receiver gradually working down to zero or nearly zero—I think about 7 pounds, something like that—and the gauge on the pipe, the main supply pipe, dropping to 20 or 25, around in that neighborhood, I have forgotten exactly.

I observed the operation in all ways that I could by listening to the concrete passing through the pipe, discharge pipe J, about 50 or 60 feet from the receiver, placing my ear to it and by observing it coming out of the pipe. I noted distinctly the passage of slugs through the discharge pipe J.

In one particular instance I had my ear against the pipe and the whole pipe made such a jump as the slug passed by, that it startled me and I jumped up. I heard smaller slugs distinctly going through.

In my opinion, there is no question but what slugs of various sizes were passing through the discharge pipe.

The operation without the top air inlet to the top of the receiver, in my opinion, is identically the same, for all practical purposes, as with it connected, because the air admitted to the point E in this photograph immediately blows up through the concrete in the receiver and con- [fol. 337] tinues to do so until the resistance to the upward flow is equal to the resistance to flow out through the discharge pipe.

As a result, at that particular moment, the pressure at the top of the receiver will be the same as the pressure at the point E, with the exception of the slight hydrostatic head, that possibly the concrete in the receiver causes, which would make a difference of possibly a pound or so according to the height of the concrete. In any case, it would not be more than three pounds.

Of course, this pressure of the air at the point E is more or less fluctuating, the fluctuations in some cases being large, which I will point out later, and in other cases being quite slight.

Whereas the pressure on top of the concrete in the receiver may not be affected by the slight fluctuations, it would be practically a steady pressure there, whereas at the bottom, there might be slight fluctuations. But when a large—or a pressure of a few pounds builds up at the bottom due to the slugs sticking a little bit at some point, or due to numerous slugs building up on the way out, the additional pressure will cause the air to flow up to the top of the receiver, so that I think it can be safely said that the pressure at the top of the receiver is substantially the same as the pressure at the point of discharge E.

Another thing which makes me believe, in fact proves to my mind that this is a pressure action purely and simply, is that this particular machine, when the air is turned on by the throttle valve K, with the opening through the dis- [fol. 338] charge pipe clear, shows a pressure at the receiver of about 7 pounds. There is nothing in the receiver then and nothing in the discharge pipe. That 7 pounds represents the pressure at the point E of the discharge pipe and represents the pressure head required to cause the flow of air, that quantity of air, the quantity that is available, to flow through the discharge pipe. It represents the friction loss and the velocity head of the air flowing through the discharge pipe.

If this was a kinetic machine, that flow could be established and the concrete dropped into it, and it would be carried on without any particular increase in that pressure. There might be a slight increase due to additional friction of this air flowing through there containing these particular ingredients distributed through it, but that would be very slight, not more than a pound or two. But in reality we find that it takes a pressure of about 45 pounds to start the thing off and gradually reducing as the charge is discharged.

The Court: Does it go up and down much?

The Witness: There is not much fluctuation in the pressure at the top. It gradually drops down due to the charge being worked out and less slugs offering less resistance. In certain instances it will go up, when a slug meets a bend or something and the rocks kind of get together so as to resist the motion then the pressure will go up.

[fol. 339] Q. 7. The gauge O, on what part of the apparatus is that located?

A. That was connected to the supply pipe back of the throttle valve, so it always showed the pressure in the pipe at that particular point.

Q. 8. And what was the distance from the point which this gauge tapped the supply pipe down to the outlet of the vessel?

A. A matter of six or eight feet, I should say. A 2-inch pipe, as I remember it, with several bends.

Q. 9. And this 2-inch pipe down at the bottom connects with the discharge pipe which was about what calibre?

A. Six inches.

Q. 10. Please state, if you can, what the difference in pressure between the gauge on the main supply pipe and the gauge P at the top of the vessel was due to?

A. It is due to the loss of pressure, of the air passing through that small piping from the point to which the gauge is connected into the point E of the discharge pipe.

Q. 11. When the air pressure was first turned on on the main air supply, how soon did the gauge at the top of the vessel rise?

A. Instantly.

Q. 12. Do you recall when the pressure on the main supply was about 45, about what pressure that the gauge P was?

A. Around 30, around in there. There was about 15 pounds drop under certain conditions.

Q. 13. And you say that the operation of the device satisfied you that the pressure at the bottom of the vessel and the pressure at the top was about the same?

A. Yes. I do not think there can be any question on that score.

[fol. 340] Q. 14. What was the quality or character of the concrete used in that test on October 7th? A. Well, it seemed to me a very peculiar type of concrete; hardly in my opinion, passable for such. It had some large gravel and fine gravel graduated down, and considerable amount of water, with apparently very little cement in the mixture. It seemed to be used for filling on the outside of the walls of the subway. Possibly anything would serve that purpose.

Q. 15. I refer you to Plaintiff's Exhibit No. 5, a blueprint in evidence, and ask you to state whether the operation that you have described in connection with the exhibition of the machine on October 7th is the same operation that will take place in the machine shown in the blueprint?

A. Yes, exactly the same. I compared this blueprint to the machine up there, and as far as I could see, it was identically the same.

Q. 16. I call your attention to Defendants' Exhibits L and M and N, and particularly to the photograph, Exhibit

N, where the material is shown discharging from the outlet or head. Can you tell us about what speed of discharge is indicated?

A. By this?

Q. 17. Yes.

A. No, I could not say about this, I could not say by this what is indicated.

Q. 18. What speed of discharge was indicated in the operation of the apparatus as you observed it?

A. Well, of course, I could not say exactly, but I observed that apparatus; I have observed other apparatus in operation; and my opinion is that the velocity of the concrete, the slugs passing through the pipe, may be some- [fol. 341] thing of the order of one hundred feet a second; maybe somewhat less than that. Something of that order, I should say, from my observation, without any exact measurements.

Q. 19. That is, the velocity of the slugs passing out of the discharge end of the pipe?

A. Well, right at the discharge end they may go faster, because at that particular point, near the end, and right at the end, there is an expansion of the air which is carried under pressure up to that point, and that expansion which occurs right at the end of the pipe, of course, would tend to drive on the concrete faster right at that point. I was speaking of the travel through the pipe itself before that end expansion takes place.

Q. 20. In your observations was the speed of the material passing through the pipe greater or less than the speed of the discharge?

A. It would be somewhat less than the speed of the discharge at that point. No doubt of it.

Q. 21. As I understand it, you have listened to the stuff passing through the line?

A. Yes.

Q. 22. And were able to form an estimate of the relative speed, more or less indefinite?

A. Yes, roughly.

Q. 23. What is indicated by that difference in speed of the material passing through the pipe and the material passing out of the end of the pipe?

A. Why, that, of course, indicates clearly that the pressure is carried right up to the end of the pipe and is released there when the slug passes out. I have seen other indications of that. In fact, some instances with these ma-[fol. 342] chines in operation, the release of the pressure is so sudden and there is such a considerable amount of pressure right at the end of the pipe, that after the slug goes by it comes out,—"boom," just like the low tone of a gun going off. You can hear it one hundred and fifty feet very readily. That, of course, is that sudden release of the pressure at the end of the pipe.

Q. 24. If the material were carried through the pipe in suspension instead of in slugs, what would be the effect on the concrete.

A. There would be a separation. The heavier material would lag back, if it could be done at all that way. If it could be fed into the air stream and sufficient velocity maintained to do that, there would be a separation and an entire separation of the materials.

Q. 25. And was there any such separation in the defendants' apparatus?

A. No, not to speak of. Not when it was operating with a better mixture. The first we saw there, they seemed to be cleaning out the machine and at one time they blew out what was mostly gravel and some rock. That is, some large gravel in with it. That did not appear in any way to be a concrete mixture.

Q. 26. And after that was discharged, what happened to the apparatus?

A. It was plugged. The apparatus was plugged right after that. There was one big slug that come out, a very large slug of gravel, when we first arrived on the scene, and then the pipe became plugged and it was an hour or two before they got it running again.

[fol. 343] Q. 27. What effect would the separation of the gravel and the finer aggregates of concrete have on the progress of the material through the discharge pipe?

A. It would have a very much more rapid flow with these pressures available. Liquid and the small particles would go through very rapidly, and the heavier parts would drag on behind.

Q. 28. Would that have any effect on the efficiency of the apparatus?

A. I think it would ruin it myself, for the purpose for which it was to be used. That is, it does not seem to me that such placement of concrete should be permitted.

Q. 29. Referring again to this photograph, Defendants' Exhibit N, if the exposure was one-tenth of a second and the material were being discharged at 100 feet per second, how far would that material move during the exposure of the film in the camera?

A. It would be ten feet.

Q. 30. And it would produce an appearance such as that you see in Exhibit N?

A. Oh, yes, clearly. The discharge there clearly forms streaks, which shows that there is a very considerable movement while the exposure is taking place.

Q. 31. Mr. Ray, I will ask you to compare the defendants' device and its operation with the specifications and the drawing of the patent in suit, and state whether you find in the apparatus the features of construction and operation described in the patent, which are referred to in the claims specified?

A. Do you wish me to refer to the various claims?

Q. 32. Yes. Refer to the features of construction of [fol. 344] the patent which are mentioned in the claims.

Mr. Morgan: Your Honor, that is a matter of law for the Court, and I object.

The Court: I sustain the objection. I do not want any testimony on that.

Q. 33. So then, Mr. Ray, please confine your answer to a discussion of the features of construction in the patent, and a comparison of them with the defendants' structure.

A. As shown on Plaintiff's Exhibit 3, the defendants' structure is identically the same for all practical purposes as the structure of the patent in suit. There are slight mechanical differences in the form of the receiver and, of course, the valves and the air piping and so on, and also a slight difference in the manner in which the air pipe is connected to the discharge at the bottom of the receiver.

In the patent in suit, it is shown, of course, entering through the top of the receiver, and then being carried

down and pointed into the discharge pipe; whereas, in defendants' device it is carried outside of the receiver and attached to the discharge pipe pointing in the direction of the flow. This slight mechanical difference, of course, in no way affects the operation, and the patent, as I understand it, is in no way limited to that particular mechanical construction shown in the patent drawings, but broadly covers the proposition.

Mr. Morgan: Your Honor, I do not want to interrupt the witness. The scope of the patent is a matter for the Court [fol. 345] and a matter of argument.

The Court: Absolutely.

A. (Continuing:) Well, I can simply state that the particular detail used in the introducing of the air supply to the discharge does not in any way affect the mode of operation of the device. In the defendants' structure as it stands at present, as shown in Defendants' Exhibit J, the air is introduced through the top of the receiver in a different manner from that shown in the patent in suit. That is, the air is taken from the air supply as connected to the discharge pipe and is carried up through the mixture in the receiver to the top of the receiver. It does this automatically as a matter of mechanics and of physics; and the same effect would occur in the device of the patent in suit if the pipe 8 were entirely removed from the top of the receiver. The device of the patent in suit would operate just the same as it operates with that pipe. The essential feature; in fact, the peculiarity of this device of the patent in suit, is that the concrete or the charge is permitted to flow bodily as rapidly as it can under the conditions existing directly into the discharge pipe, this flow being automatically governed by the pressures existing on the top of the concrete and at the point of discharge of the receiver into the discharge pipe. This is the distinctive characteristic in which this device of the patent in suit differs from kinetic devices which are common in the prior art. In kinetic devices, it is necessary to establish a high velocity of air or other gas and to take precautions to prevent the substance [fol. 346] which is to be carried from flowing freely into the discharge pipe, else the whole system would break

down and the discharge pipe would become plugged, and that is the end of the operation.

In old kinetic devices the material in the first place must be in granular form so to be readily subdivided into its smaller particles, and in the second place it must not feed too rapidly into the discharge pipe. Furthermore, in kinetic devices there is no pressure at the bottom of the receiver, or else a very slight one, in fact, in the great majority of them they have a vacuum at this point, that is, at the point of discharge of the receiver.

As I said before, the operation of the McMichael device and the defendants' device depends upon a distribution of pressure between the top of the receiver on top of the concrete and in the discharge pipe at the bottom of the receiver, and this distribution of pressure, this relation between those two pressures is constantly changing, thereby permitting the feeding of the concrete into the discharge pipe, carrying it on by the pressure resulting in a drop of pressure at this point and further feeding of the concrete, and so on.

Q. 34. When you observed the defendants' machine in operation, how did the pressure on the main gauge come down?

A. It came down fairly gradually. There were little slight fluctuations, but not very marked, and it would hardly be expected that it would show much fluctuation at the point; a gauge attached directly to the bottom of the receiver at the discharge pipe would show greater fluctuations without any doubt.

[fol. 347] Q. 35. It is your opinion that the fluctuations and pressure at the discharge outlet were absorbed to a great extent between the pipe and the gauge at that outlet?

A. They would not show so marked on the gauge as they would at the discharge.

Q. 36. Can you state what effect the peculiar discharge head used by the defendant had on the manner in which the material was discharged?

A. It has a tendency to absorb the fluctuations and preventing the violent downward discharge of the concrete.

In other words, the concrete flowing through the pipe continues on due to its velocity and being heavier than the

air and hits the blocked end at 50 and then drops down more quietly than it would otherwise.

By the Court:

Q. 37. Is that particular defendants' apparatus the only one that has been shown to you?

A. That is the only one we saw.

By Mr. Cox:

Q. 38. I want you to state briefly whether it would have been possible at that operation that you saw on October 7th to convey that concrete from the apparatus which I believe was 55 feet below the street level, up around the eight or more bends in the pipe, to the street, kinetically, and why?

A. I would not say that such a thing was possible if sufficient air was available, sufficient velocity. However, [fol. 348] with the air that was available and the velocities that did occur, that would be absolutely impossible. It is the simplest thing in the world to see that such would be the case.

Now, air moving through that pipe had a velocity of 100 feet a second; that represents a velocity head of about 150 feet of air. Water moving through that pipe at 100 feet velocity represents a velocity head of 150 feet of water; and so on with any liquid.

In other words, the velocity with which liquid or gas is moving, the same velocity always gives the same velocity head without regard to the particular thing that is moving. 150 feet of air would represent about a little less than 2/10ths of a foot of water, which is about 1/10th of a pound pressure. In these kinetic machines the moving power of any stream flowing depends upon the velocity head, the difference of velocity between the velocity of a particle being carried and the velocity of a fluid. So if the stone or concrete or what not in this pipe was not moving at all, but this stream of air moving at 100 feet a second was impinging upon it, it would represent a pressure of about 1/10th of a pound per square inch against that particular object. Well, of course, that naturally would not move the rock and would not carry it out. It would not do anything.

In fact, it takes many pounds of pressure to do it, to move up that concrete. I could not say what velocities offhand it would take in the pipe. They could be approximately calculated with any given sized stone and so on, but it would take a velocity of many hundred, possibly thousands of feet [fol. 349] a second to do it, and no such velocity as that is possible.

Q. 39. What effect would that have on the apparatus Could you build an apparatus strong enough to stand that sort of thing?

A. I would not say what could be done, but the kinetic system is not feasible from other standpoints. In other words, with concrete consisting of large stones and with the fine sand and fine gravel and more or less viscuous mortar all connected together, it would be very difficult to make the kind of an apparatus in which that mixture could be fed in uniformly into the moving air, so it could be conveyed kinetically to begin with.

In my opinion, the whole thing is impossible with concrete. With grain and sand and such things, they can be fed in very uniformly and be picked up and carried on with reasonable velocities. They are small. The smaller the particle, of course, the greater the area in proportion to its weight. The areas which are subject to the pressure of the moving air varies as the square of the dimensions, whereas the weight varies as the cube of the dimensions, so velocity of 100 or 200 feet a second might carry along grain very nicely, whereas to carry rocks an inch or two in diameter, would require velocities very much greater.

Q. 40. What would be the effect on the operation of the defendants' apparatus and the apparatus of the patent in suit if the air valve at the top of the vessel were opened so as to admit too rapidly or more rapidly than the necessities of the machine required?

A. Which valve are you referring to now?

[fol. 350] Q. 41. I am referring to opening the top valve on the vessel quickly and admitting a large volume of air under pressure?

A. Before the bottom air supply is opened?

Q. 42. Before and after.

A. There is, of course, if it is opened before in particular, a tendency of pressing the concrete in the receiver down in

the discharge, there is a tendency of jamming it there. If the air pipe to the discharge is opened first and then the air turned on at the top, then the lower pressure, lower jet, lower pressure at that point, takes care of it and carries off the slugs without jamming. Building a higher pressure on the top of the concrete tends to make it feed faster, tends to carry larger slugs, tends to make the slugs larger and, of course, there is more danger of blocking, particularly if there is not sufficient air.

Q. 43. Is it then quite possible to plug up the material and put it out of operation by admitting too much air to the top?

A. I think that could be done if too much pressure were admitted at the top, yes.

Q. 44. When you observed the operation of this machine on October 7th and after the operation was completed, what was done with the machine?

A. Simply closed down, the air valves closed off, nothing further done that I observed. I waited around some time but nothing further was done as far as I saw.

Q. 45. How long were you there?

A. Maybe fifteen minutes or half an hour. Then I went up the next morning. It apparently had not been used any further. It was not being used then.

Q. 46. Was the apparatus washed out when the operation [fol. 351] was completed?

A. Not as far as I saw, nothing of that kind was done as far as I observed.

Q. 47. And did the operator go away and leave the apparatus without doing that?

A. Yes.

Mr. Morgan: That is, as far as you know?

The Witness: As far as I saw at the time. He might have come back, of course; I don't know.

Q. 48. I want you to say as to whether you found in the defendants' apparatus as observed by you a receiver at the top of the vessel separated from the vessel by a door or seal.

A. Yes. There is such a receiver. It is marked G in that photograph, and the hopper; the valve is just below it, by A.

Mr. Morgan: What are you referring to now?

Mr. Cox: I am referring to photograph of defendants' apparatus.

Mr. Morgan: Plaintiff's Exhibit No. 3? Please put that in the record.

Mr. Cox: He is talking of the apparatus as he saw it.

Mr. Morgan: When?

Mr. Cox: When he says he saw it.

Mr. Morgan: When did you see it?

The Witness: This last week.

The Court: October 7th.

Mr. Morgan: Just so it is clear.

The Witness: Yes, there was a receiver in the apparatus.

[fol. 352] Q. 49. Was there a bend in the discharge pipe at a point adjacent to the chamber?

A. Yes, there was.

Q. 50. Was there a discharge duct extendnig through the chamber in a horizontal plane?

A. Yes, there was.

Cross-examination.

By Mr. Morgan:

X Q. 51. Are you the Mr. Ray who testified as an expert for the plaintiff in the prior suit against the Ulen Contracting Corporation?

A. Yes.

X Q. 52. In your testimony as to the form in which the discharged matter passed through the pipe and to its velocities, you were simply drawing inferences from listening?

A. Not entirely.

X Q. 53. You could not see it in the pipe, could you?

A. See the discharge in instances.

X Q. 54. But the pipe was an iron pipe?

A. Yes, in these cases.

X Q. 55. At the point of discharge did you test the velocity of discharge or just estimate it from your eye?

A. No. I had no way of testing it at the discharge; but in some cases it has been possible to hear it coming from when it left the receiver until it reached the discharge, and a rough estimate could be made that way.

X Q. 56. And when you saw this on Thursday, as the material was discharged on the street, was it not into a box?

A. That is correct.

X Q. 57. And it was discharged through a pipe plugged at the end with a slot inside?

A. Yes.

X Q. 58. And there was a tin plate placed over the pipe for the splashing?

A. Yes.

[fol. 353] X Q. 59. Did you not observe that after the charge was discharged into the box, that the stone was in a mass practically beneath this slot in the pipe?

A. In the first instance I referred to, I spoke of that very fact, but in my opinion that was due to the fact that the mortar was nothing more than water with a mere coloring of cement. Of course, naturally the water would flow away, leaving the stone there. It was not like a concrete mixture.

X Q. 60. You made no test whatsoever as to the proportions of cement, sand, water and stone in the charge delivered, did you?

A. Just from observation, I did.

X Q. 61. You made no test? Please answer my question.

A. What do you call a test?

X Q. 62. Anything you like?

A. All right, I am giving my test; by my observation of the consistency of it and by various members of the party taking it up in their hands and observing it.

X Q. 63. Those were the only tests?

A. Yes.

X Q. 64. And in the subsequent discharges of material, did you notice that a blast of air came out first?

A. Why, certainly.

X Q. 65. And did you notice that next came out a thin mixture of sand and cement and water?

A. No.

X Q. 66. You did not?

A. No. I saw in one case——

X Q. 67. And you and I——

Mr. Cox: Let him answer his question, please.

[fol. 354] A. (Continuing:) I saw in one case a very large slug of gravel of various sizes coming out.

X Q. 68. You and I, Mr. Ray, were standing within ten feet of that box, quite near to each other, were we not?

A. Yes.

X Q. 69. And did you not notice after this thin discharge of sand, cement and water, came out, that the bulk of the stone came out in one mass right at the end of the discharge. Did you not see that?

A. No, I would not say that that were so, except in that first instance, which appeared to be a case of cleaning out the machine as far as I could determine.

X Q. 70. You and I were standing practically side by side within ten feet of that box, were we not?

A. I think we were.

X Q. 71. Was not that true of the last discharge, just as I have outlined?

A. You mean the last one that occurred while we were there?

X Q. 72. Yes.

A. No, I did not think so. I saw the sand and gravel of various sizes and the concrete fluid, whatever it might be, coming out together, but possibly I could not say that, that every portion was perfectly mixed. I would not pretend to say that, but I would say they came substantially together for practical purposes.

X Q. 73. And the material that was discharged into the box was put into a buggy and taken across the street and used on the other side of the street?

A. Yes.

X Q. 74. Did you observe, Mr. Ray, that one of the workmen who filled those buggies from the box, shovelled the stone from directly beneath the slot in the pipe and put it in the buggy?

A. Certainly.

[fol. 355] X Q. 75. And did you not notice that the liquid, the fluid sand and cement and water was bailed up in a bail from the other side of the box?

A. Of course. It was not a real concrete mixture, as I said before.

X Q. 76. And you also said that you did not test this mixture as to its relative components?

A. I observed it pretty carefully.

X Q. 77. But you did not test or measure it in any way, did you?

A. No, not scientifically.

X Q. 78. Are you familiar with steam piping in the ordinary buildings for heating?

A. More or less.

X Q. 79. Have you heard water hammers in the steam piping?

A. Yes.

X Q. 80. In plaintiff's patent in suit compressed air is admitted through the pipe 8, is it not, above the concrete in the receptacle 2?

A. Through the pipe 8?

X Q. 81. Yes.

A. Yes.

X Q. 82. And this air pressure forces the concrete downward into the discharge pipe 13?

A. Under certain conditions.

X Q. 83. Is that the statement of operation of the mechanism in the patent in suit?

A. It says the top air is to apply a uniform pressure to the entire mass surface and without any substantial penetration of air itself into the interior of the mass.

X Q. 84. Is that the only statement of the patent in suit as to the operation of the top air?

A. There may be others. I will have to look through that.

X Q. 85. You have been testifying rather positively as to this devise.

A. You are asking me exactly what the patent states, as [fol. 356] I understand your question. It says on page 1 that,

"The air inlet into the chamber being preferably near the top thereof, and the passage of air through the connection 8 being controlled by a valve 9."

X Q. 85. Please state whether or not the concrete shown in the receiver in the drawing in plaintiff's patent is not impervious to air?

A. I should say that with the air on top, for all practical purposes, it would be impervious to it.

X Q. 86. Your answer to my last question then is yes?

A. No, it is not yes. It is just as I answered it. It depends on your meaning of your term "impervious."

X Q. 87. I mean the usual dictionary meaning of that term; you will find it in any standard dictionary.

A. This concrete mass in the receiver of the usual consistency in that respect would not be much different from water. Placing air——

X Q. 88. We are not interested in mortar.

A. Water. I am talking about water. Pressure of air placed on the top of water in a vessel, for practical purposes the water can be said to be impervious to air, but that does not mean that under other conditions that the air would not pass right through the water.

X Q. 89. I am asking you again to look at the drawings of the patent in suit and state whether or not the concrete in the receptacle 2 in that drawing is or is not impervious to air?

A. Under the conditions set forth in the specifications, when that statement was made, it is for all practical purposes impervious to the air.

[fol. 357] Redirect examination.

By Mr. Cox:

R. D. Q. 90. Mr. Ray, will you please refer to the prior patents discussed by the defendants' expert and explain briefly what is shown there?

A. I am not certain that I have——

The Court: He discussed but two or three as I remember it.

A. (Continuing:) I believe he discussed patent to Warren No. 671,303. This is a mere kinetic device similar to many others discussed in the prior case, in which sand was fed in gradually into a moving stream of air and carried along by it kinetically. In this case it shows means to admit pressure at the top of the sand receiver so as to cause the sand to flow down through the restricted opening more uniformly, just as common in many others. It says, page 1, line 67:

"into the blast of air, with which it mingles and by which it is carried through the chamber into the flexible tube M and discharged through the nozzle O."

The patent to McIlvrid, 958,421, shows a grout mixer consisting of a closed chamber with mechanically operated paddle wheels into which is placed the mixture of cement, sand, water, possibly very fine gravel, and there mixed together. Then the air pressure is placed above the body of the liquid in this receiver and forced out through a dis- [fol. 358] charge pipe and through a hose, into a place to be used, at the bottom, just as if it was water. That is a case of pure fluid flow under pressure in a receiver.

The patent to Canniff, 873,345, shows also a grout mixing and discharging apparatus, having a closed receiver for the cement, sand, water, possibly fine gravel. The particular novel feature of this is that air from the air supply is permitted to flow down through the bottom of the receiver, bubbling up through the mixture, and thereby mixing it together. After it is mixed, a three-way valve is turned, shutting off the air at the bottom and permitting a pressure at the top when the fluid mixture flows through a pipe and through a hose to the point to be used, just as if it was water. Another case of pure fluid flow through a pipe under pressure.

R. D. Q. 91. Do you find any distinction made in the patent in suit between the grout and concrete?

A. Yes. Grout is defined in the patent in suit as a mixture of sand and cement and water, possibly fine gravel; whereas the concrete has the rock and usual ingredients. It distinguishes clearly, and refers to the prior art, that in the prior art there were these grout-mixers and conveyors, this very type shown in the Canniff patent.

That patent to Davidson is a kinetic device pure and simple. The air current is obtained by a blower or fan of the centrifugal type which commonly is capable of only developing a pressure of a few ounces, and in this case the [fol. 359] velocity of air from this blower passes through the pipe, and tobacco leaves, wood chips and tea leaves are fed into the pipe and are conveyed kinetically by the moving

stream of air and floated along; similar to many devices of the prior art.

The patent to Beach, 267,318, shows a pneumatic conveyer for conveying grain possibly, or other objects, in a state of suspension in the air in the tube and without contact with the sides of the tube. This is like all the kinetic devices in that there is a current of air passing rapidly through a tube and from a receiver there is fed the fine granular substance regulated through a valve so only a given quantity is fed into the current, and it is carried kinetically or floated by the current and discharged into a peculiar kind of discharge tank where, if desired, it is picked up again and goes through the same operation, and is carried further. In the receptacle for the grain or other granular substance there is at the top connection for air pressure, so it can be fed more uniformly, if desired; but this patent does not require air pressure at any point. In fact, it can operate under vacuum. It is a pure kinetic machine, and as far as I can see, has no bearing on the patent in suit.

The last patent is the patent to Smith, 122,498, which shows a peculiar form of concrete mixer, the idea being to use a very fluid mixture which is capable of flowing out of that concrete mixer directly in many instances upon the road which this machine is particularly adapted to build. [fol. 360] The concrete flows from the mixer through these pipes to the middle of the road and spreads out so that it spreads all over the road and forms the concrete surface. Under other conditions, where they would have to lift it to a point higher, and where gravity is not sufficient, they first let the mixture flow into a receiver, which is then closed, and air pressure is applied to the top and it then flows out through the pipe. In either case it is nothing more or less than a pure fluid flow caused either by gravity or the pressure of the air on the top of the surface of the concrete in the closed vessel.

R. D. Q. 92. Mr. Ray, I want to ask you a question about the machine shown by the sketch introduced by Mr. Artingstall, Defendants' Exhibit E. Please tell us how that machine, the two machines shown on E would operate, with grout?

A. With grout they would operate with the top pressure only. In fact, as grout is used, it is injected into a closed space, the idea being to fill up that space. In my opinion if air was injected into the grout and carried along with the grout, it would defeat the whole purpose of the use of such a machine. In other words, these grout machines are used for obtaining a fluid flow of the grout through a hose. That is the pure grout just as you would take water out of a garden hose under pressure, pressure at the discharge, and the discharge of this hose is introduced as tightly as possible in the particular point where the grout is to be used, and the grout forced in under pressure so as to fill up cavities completely.

[fol. 361] R. D. Q. 93. Taking Fig. 2 of Exhibit E which I believe Mr. Artingstall has said was used for concrete or something of that nature, can you state about how that would operate?

Mr. Morgan: That is his opinion how it would operate.

Mr. Cox: This is all opinion, of course.

Mr. Morgan: As long as it is understood.

A. If such a device was constructed and operated with concrete, it would operate, if at all, with concrete in the same manner as the patent in suit operates. In other words it would be a pressure device if it operated whatever with concrete. In other words, as I have stated time and again, it is my opinion that it is impossible to handle concrete with any kinetic device so far developed, at least.

R. D. Q. 94. What would be the effect of the large diameter bottom pipe extending to the left of the discharge opening?

A. It would, of course, reduce the velocity of the air from the supply pipe, so that there could be no possible kinetic effect like a nozzle at the bottom of the receiver.

R. D. Q. 95. What effect, if any, would that have on the efficiency of the machine?

A. It would spoil it for a kinetic machine.

R. D. Q. 96. Mr. Ray, what is the weight of concrete?

A. About one hundred and fifty pounds to the cubic foot.

R. D. Q. 97. What is the relative weight of air and water?

A. Well, air at atmospheric pressure is about one eight-

[fol. 362] hundredth part of the weight of water.

R. D. Q. 98. And what is the specific gravity of rock?

A. That varies a great deal.

R. D. Q. 99. Taking limestone?

A. Two to three times the weight of water; sixteen hundred to twenty-four hundred times the weight of air at atmospheric pressure.

H. B. KIRKLAND, called as a witness on behalf of the plaintiff, in rebuttal, having been previously sworn, testified as follows:

Direct examination.

By Mr. Cox:

Q. 1. Mr. Kirkland, have you heard the description of the construction and operation of defendants' apparatus and the conditions thereof on October 7th, at the Queensboro subway extension, given by Mr. Ray?

A. Yes, sir.

Q. 2. Please state whether or not that description is correct to your own knowledge and is in accord with your observations made at the same time?

A. Yes, sir.

Q. 3. Mr. Kirkland, you have stated in your previous testimony that the pneumatic concrete placing machines made under the patent in suit, made a saving of one-third to one-half over the cost of hand placing not under air pressure. Is the saving greater or less under air pressure?

A. It is greater under air pressure.

[fol. 363] Q. 4. Has the extensive use of the apparatus which you testified to about some year and a half ago continued since that time?

A. Yes, sir.

(No cross examination.)

STIPULATION RE TESTIMONY OF WM. H. LARKIN

(It is stipulated between counsel that the witness William H. Larkin, if called, would testify to the same effect as the last witness, relating to the construction and operation of

the defendants' apparatus and as has been testified to by Mr. Ray.)

SUR-REBUTTAL PROOFS

ALAN M. JOHNSON, called as a witness on behalf of the defendants, in sur-rebuttal, being duly sworn, testifies as follows:

Direct examination.

By Mr. Morgan:

Q. 1. Mr. Johnson, please state briefly and clearly what you saw when the concrete was discharged from the pipe at the Forty-second Street tunnel on last Thursday.

A. Do you not want me to state I am counsel also in this case?

Q. 2. Yes, go right ahead and make that statement.

A. As associate counsel in this case, I was present at this [fol. 364] inspection of the blower and the material was blown up on the street into a box. It was very wet. The first blow, some of the rock came out and then the pipe stopped up, and there was probably an hour or hour and a half until it got running again. After it was successfully run, the operation was like this:

First, there came out of the pipe air, which I suppose was the air left in the pipe. Then a few stones that may have been left from the preceding blow. Then a large quantity of water, sand and cement; and then a large mass of stone by itself. And that material was removed from the box by the laborers, some of whom shoveled out the rocks and others bailed out the liquid by a bail into a buggy, I think they call it.

Cross-examination.

By Mr. Cox:

X Q. 3. Mr. Johnson, how long did it take to discharge the whole batch of concrete?

A. I did not time it, Mr. Cox. You were right there. It took a few seconds. I did not have a stop watch or anything of that kind. It was an appreciable time.

X Q. 4. What is your best recollection? You were out to observe it particularly?

A. We all were. We were right around the box.

X Q. 5. This stone that you mentioned——

The Court: When you ask him what his recollection is, do not mix your sentence up. What is his recollection?

[fol. 365] X Q. 6. What is your recollection as to the time?

A. A few seconds between the air that came out and the water, sand and cement, and then one, two or three, I do not know how many seconds, Mr. Cox, between the batch of stone which was practically by itself. In fact, the material separated in the pipe.

The Court: He is not asking you that. He is asking how long it took to observe this batch.

The Witness: Is that the question?

X Q. 7. Yes.

A. I did not time it. I could not tell. A few seconds.

X Q. 8. A few seconds?

A. I could not tell. I do not know.

The Court: One second?

The Witness: Oh, no, I should say more than ten or fifteen seconds. Maybe twenty.

X Q. 9. That is more than a few, is it not?

A. Well, I do not deal with seconds very much, sir.

X Q. 10. What you saw and what you testified to took just a few seconds, did it not?

A. I will say from what I saw, I should say it took from five to twenty seconds or maybe twenty-five seconds.

X Q. 11. Did it take twenty seconds to discharge this stone that you speak of?

A. Not after it came; but you are speaking now about the entire blow; that is, the first air——

[fol. 366] The Court: The entire blow before they admitted the new batch?

The Witness: Yes, sir.

X Q. 12. I want to ask you, Mr. Johnson, what was the consistency of that concrete?

A. It was as thin as soup, sir.

X Q. 13. And the water could be seen on the top of the box in which it was discharged after it had settled in the box?

A. Oh, yes. The water ran off around the side of the box, and the stone came down in its own pile right underneath the slot.

X Q. 14. You could see the water on the top of the mixture when it was discharged in the box standing there?

A. The water and cement and sand seemed to stand by itself.

X Q. 15. I say you could see the water on top, pure liquid?

A. It was colored, you know. Colored with cement.

JOHN P. FITZGERALD, called as a witness on behalf of the plaintiff, in rebuttal, being duly sworn, testifies as follows:

Direct examination.

By Mr. Cox:

Q. 1. Where do you reside, Mr. Fitzgerald?

A. New Jersey.

Q. 2. For a number of years past have you been engaged largely in setting up and operating pneumatic concrete placing machines?

A. I have, yes, sir.

[fol. 367] Q. 3. Did you witness the operation of defendants' machine at Broadway and Forty-first Street on October 7th?

A. I did.

Q. 4. I want you to tell me what the character of that concrete was that they were using there.

A. It was very poor concrete. It was very sloppy, and would not be passed by any inspector under any circumstances.

Mr. Morgan: I object to that, your Honor, and move to strike out it would not pass inspection.

The Court: Motion granted.

Q. 5. Have you observed the character of concrete required by inspectors and engineers on the jobs you worked on, very carefully?

A. Yes, sir; always.

Q. 6. How did this concrete compare with it?

A. Very poorly.

Q. 7. Do you know the action of concrete after it is mixed and placed?

A. I did not get that.

Q. 8. Do you know the action of concrete after it is mixed and placed?

A. Yes, sir; I do.

Q. 9. Would that concrete form satisfactory concrete?

A. No, sir; it would not.

Q. 10. Now, how long did it take to discharge a batch of that apparatus?

A. Better than a minute.

Q. 11. More than a minute?

A. Yes, sir.

Q. 12. And do you know Mr. Johnson, who is sitting here?

A. I do, yes, sir. I do not know him. I saw him.

[fol. 368] Q. 13. Was he there at the time?

A. Yes, sir; he was.

Q. 14. When this operation took place on the 7th of October?

A. Yes, sir; he was.

Q. 15. And you were dressed in your khaki clothes?

A. My working clothes, yes, sir.

Q. 16. Did you have any conversation with Mr. Johnson?

A. No, sir; only he made some remark about the concrete, and I said, "Very unusual to be as wet as that." And he told me to keep quiet, something like that.

Q. 17. Did he know who you were?

A. I do not think he did, no, sir.

Q. 18. Mr. Fitzgerald, how did the concrete come out of that machine on October 7th, at the discharge pipe?

A. It came out in sections. I would say, first came in sections of concrete, then air, and then sections of concrete.

Q. 19. Was the concrete separated?

A. No, sir.

Mr. Cox: I have a model that Mr. Ray has made, demonstrating the operation of this machine in glass. I think we can use that.

Mr. Morgan: I object to that.

Mr. Cox: I would like to have Mr. Ray produce that. It is very interesting; just to say he made that model, and so on.

Mr. Morgan: This is with reference to the operation of a heavy cast iron outfit.

The Court: Never mind that.

(Both sides rest, and argument set for Friday, October 15th, 1926, at 3:30 o'clock P. M.)

[fol. 369] Friday, October 15th, 1926.

(Plaintiffs counsel introduced in evidence a copy of the specifications of the Transit Commission, under which the work on the Queensboro Extension was done by the defendants, subject to correction.)

(Marked Plaintiffs Exhibit No. 19.)

[fol. 370] PLAINTIFF'S EXHIBIT NO. 1

Stipulation

1. It is stipulated by and between the parties hereto that the plaintiff is a corporation organized and existing under and by virtue of the laws of the State of Illinois, having its place of business in the City of Chicago, in the County of Cook and State of Illinois, and that said plaintiff is the owner of all right, title and interest in and to patent 1,127,660, the patent in suit, and of all claims and demands for profits and damages for past infringement thereof.

2. It is further stipulated and agreed by and between the parties hereto that an ordinary uncertified copy of the opinion of his Honor Augustus N. Hand and similar copies of other papers on file in the suit in this Circuit, entitled "Concrete Mixing & Conveying Company vs. Ulen Contracting Corporation & Shandaken Tunnel Corporation" may be referred to and offered in evidence in this suit with the same force and effect as a certified copy of said opinion or other papers subject to correction of any errors.

3. It is further stipulated by and between the parties hereto that the ordinary Patent Office printed copies of the U. S. domestic patents, and the ordinary printed copies of foreign patents may be used in evidence with the same force and effect as regular certified copies, subject to correction, if errors should appear.

[fol. 371] 4. It is further stipulated by and between the parties hereto that the claims of the McMichael patent 1,127,660 sued upon are the same claims as those passed upon by his Honor Augustus N. Hand, to wit: Claims 2, 4, 6, 17, 21, 22, 28, 34 and 35, and also claims 5, 8, 9, 12, 15, 19, 24, 31, and 32.

5. It is further stipulated that an ordinary uncertified soft printed copy of the patent in suit, printed by the U. S. Patent Office, without the grant, may be used with the same force and effect as the original patent.

Stephen J. Cox, Solicitor for Plaintiff. John D. Morgan, Alan M. Johnson, Solicitors for Defendants.

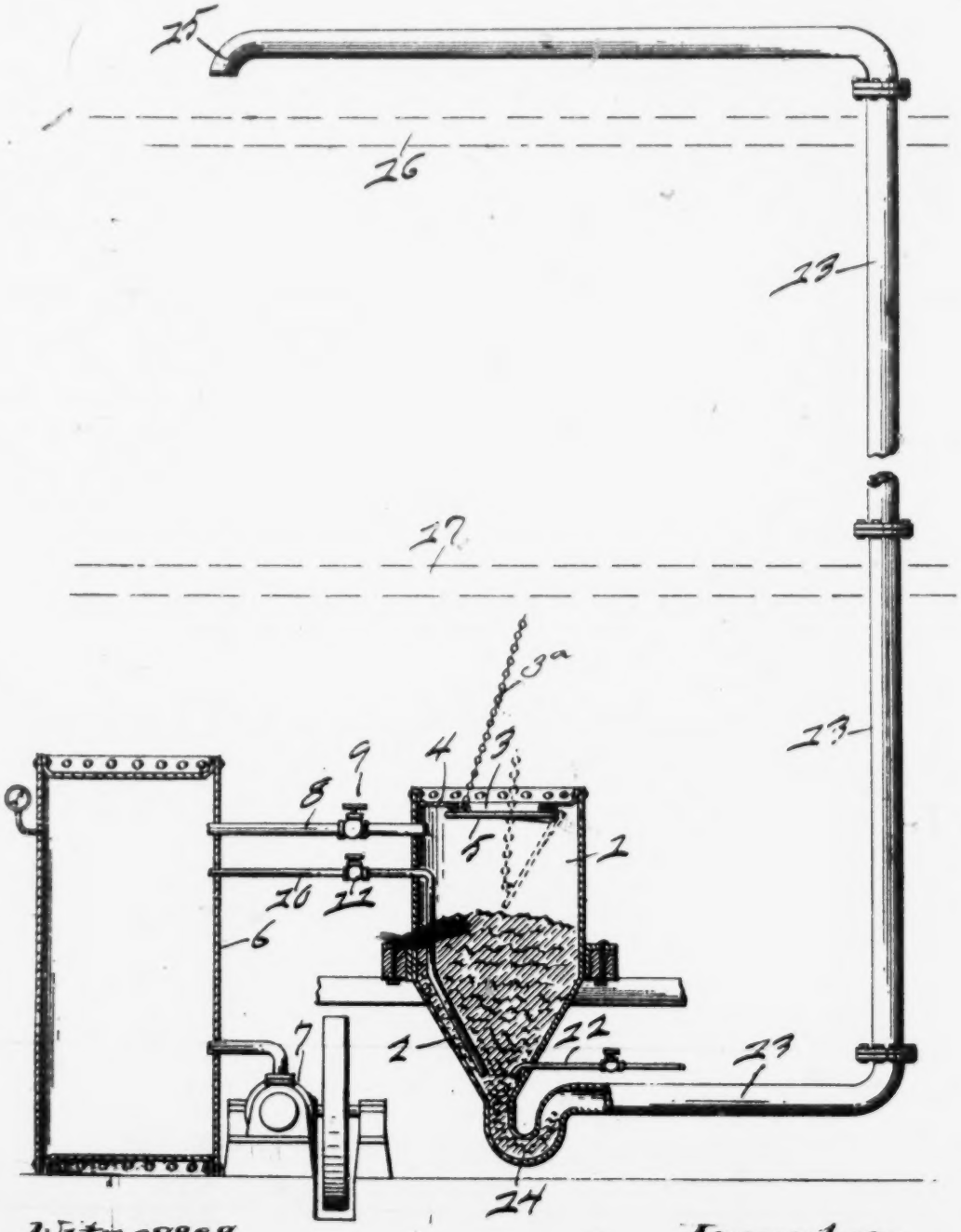
Dated New York, N. Y., May 3, 1926.

J. H. McMICHAEL.

METHOD OF AND APPARATUS FOR TRANSPORTING AND TREATING CONCRETE.

APPLICATION FILED JAN. 14 1907. RENEWED JAN. 23. 1911.

1,127,660. Patented Feb. 9, 1915.



Witnesses,
A. J. Dalton
W. O. Tracy

Inventor,
J. H. McMichael
By Earl & Tullar
Atty.

UNITED STATES PATENT OFFICE.

JOHN H. McMICHAEL, OF TOLEDO, OHIO, ASSIGNOR TO CONCRETE MIXING AND CONVEYING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

METHOD OF AND APPARATUS FOR TRANSPORTING AND TREATING CONCRETE.

1,127,660. Specification of Letters Patent. **Patented Feb. 9, 1915.**

Application filed January 14, 1907. Serial No. 352,089. Renewed January 23, 1911. Serial No. 604,236.

To all whom it may concern:

Be it known that I, JOHN H. McMICHAEL, of Toledo, county of Lucas, and State of Ohio, have invented certain new and useful Improvements in Methods of and Apparatus for Transporting and Treating Concrete; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form part of this specification.

This invention relates to a method of and an apparatus for transporting and treating concrete.

The invention has for its object to provide a method of and an apparatus for elevating and transporting material of the character mentioned in a more expeditious manner and with greater facility than is possible by the employment of ordinary methods and mechanisms.

In carrying out my invention I employ the apparatus illustrated in the accompanying drawing, the same being shown partly in section.

Referring to the details 1 is a receiver or chamber for the material to be treated or transported, the lower portion of the chamber being conical or hopper-like in form as indicated at 2. The cover or top 4 is provided with an upstanding circumferential rim which adapts it for use as an initial receiver or charge holder for materials to be deposited in the chamber 1. The cover 4 is provided with an opening 3 in which there is a door or removable seal 5 hinged or otherwise mounted so as to close the opening when it is in the position indicated by the full lines of the drawing.

3ª is a chain or rope connected with the seat and adapted to be used for partially or entirely closing it and holding it in closed position.

It will be observed that if air pressure is supplied to the interior of the chamber, (as will be hereinafter described) after the seal is closed or nearly closed it acts upon it and aids in holding it in closed position.

6 is a pressure tank or reservoir for compressed air supplied by an air-compressor 7, and 8 is a connection leading the air under pressure from the tank to the chamber 1, the air inlet into the chamber being preferably near the top thereof, and the passage of air through the connection 8 being controlled by a valve 9.

10 is an air-pipe controlled by a valve 11, and also leading air into the chamber, the delivery end of said pipe being at or near to the discharge or lower end of the hopper 2. There is also a valve-controlled water supply-pipe 12 adapted to deliver water at the lower end of the hopper when desired.

Leading from the lower end of the hopper 2 is a conveying-tube or discharge duct 13 having a crook or U-shaped bend 14, the delivery end of the conveying-tube being at 15. The broken lines 16 and 17 indicate the floors of a building, the conveying-tube in the illustration, being shown directed upward to elevate the material deposited in the chamber, the delivery end extending in a lateral direction to deliver the material at the most convenient point on the floor.

In operation, the material to be elevated is deposited in the chamber through the opening therein, falling into and occupying the hopper-like lower portion thereof, as shown. The door for the opening in the chamber is then closed and the air turned into the chamber from the reservoir, the air in which may be maintained under any desired pressure. The instant the air is turned into the chamber the door for the closure will be firmly held in closed position by the air pressure. Owing to the pressure in the receiver the material in the hopper will be forced downward and directed into the conveying-tube, being carried along by the latter until it is finally discharged at 15. Owing to the provision of the U-shaped bend in the conveying-tube immediately after leaving the hopper, the material will be more or less tightly packed as it is directed therethrough. To provide the required amount of moisture to serve as a lubricant to start the material out of the hopper and also to aid its movement within the conveying-tube, water from the pipe 12 may be turned into the lower part of the hopper to mix with the material as it enters the conveying-tube. This water introduced through the pipe 22 and mixed with the other materials gives increased fluidity to the mass and permits it to be more readily handled.

As long as the air pressure in the chamber is maintained, the closure for the opening thereinto remains closed. However, the instant the material is discharged from the end 15 of the conveying-tube, the air pressure will drop and the door will open automatically and serve as a signal to the operator of the apparatus to shut off the air to the chamber. On account of the high air pressure serving to hold the door 5 in closed position, the supplying of material for the next charge can be commenced as soon as the door has been closed. In this way time will be saved at each charge. The material which accumulates in the charging region 4 will be automatically discharged into the chamber 1, as soon as the pressure is sufficiently relieved by the discharge of the material out of the end of the pipe at 15, to permit the seal to open.

To loosen the material at the lower end of the hopper and to assist its movement, I provide the additional air-pipe adapted to discharge air into and through the material.

It will be observed that the pipe 8 serves primarily to produce the air pressure in the chamber 1, and maintain it until the charge is expelled. The lower air pipe 10 which extends to a point immediately adjacent the delivery pipe or discharge duct 13 serves the double function of preventing choking in the entrance to the delivery pipe and of supplying air under pressure in sharp jets directly to the delivery pipe itself. I have found that the supplemental air pipe 10 is very effective in aiding the passage of the material into and through the conveyer pipe. The pressure in the chamber supplied through the pipe 8, is, of course, to a certain extent expended in overcoming friction, and in cases where the friction is serious, the second air pipe located at or near the entrance of the delivery pipe, gives to the material the velocity which is needed to carry it to the remote point of delivery.

It will be observed that the upper air pipe 8 serves merely to supply air to the upper part of the chamber, 1, the pressure of the air being uniformly applied over the entire upper surface of the mass. The lower pipe 10, however, serves to direct a jet of air moving at a considerable velocity directly against portions of the mass as they move toward and into the discharge duct. The two pipes thus act in very different ways, the upper pipe supplying air which acts by pressure and the lower pipe supplying air which acts by velocity. On account of the presence of large and small particles, and on account of the presence of water, a mass of concrete forming materials (whether completely mixed or not) is relatively compact and impervious to air, and on this account the upper air body acts by applying a uniform pressure to the entire upper mass surface and without any substantial penetration of the air itself to the interior of the mass. Air from the lower pipe 10 may force itself into the body of the mass, and the relatively small air jet acting upon the relatively large stream of outward moving materials directly engages with the sub-masses to push them along. This action of the two air bodies in my apparatus is to be contrasted with the action of air in earlier devices which were so constructed that light materials such as grain or ashes could be caught in large moving air bodies and carried along in suspension with each particle separated from the others. One of the strongly marked and novel matters incident to this provision of the pipe 10 for introducing air directly into the discharge pipe, whether considered by itself or considered as supplemental to the agency such as the air from pipe 8 tending to effect downward and forward propulsion of the entire mass, is this, that the rapidly moving air from pipe 10 acts upon sub-masses, successively of the general mass, at points near those where they enter the delivery pipe, the result being that the thorough commingling of the ingredients (rock pieces, sand, cement and water) well understood by the engineer to be essential to a perfect concrete, can be attained with great rapidity and with a perfect, uniform, distribution of the various ingredients as concerns the relative positions of all the component particles.

As is well known, the material referred to as concrete is a composition containing relatively large pieces of rock or stone, as uniform in size as possible, together with predetermined proportions of sand, cement and water. The purpose of this composition is, ultimately, to have, in a desired position, a hard rock-like body which will resist disintegration and fracture. The relatively large pieces of rock components must, in order to attain this end, be thoroughly coated, over all their faces, with a layer of the binding material (cement, sand and water) in the proper proportions, chemically, to insure that, from and after the instant of commencement of the "setting" or crystallizing action of the mass, all the particles shall be uniformly in their necessary distributive relation, and particularly to insure that the relatively large pieces of rock shall, throughout the mass, be held, at all points of the surfaces of each, with the necessary cohesion. Prior to my invention builders have aimed to secure this desideratum (in the mixing or commingling of the ingredients) either by manipulating predetermined masses of the several ingredients with shovels, or other hand tools, or by subjecting them to the action of mechanical mixers of one form or another, prior to taking them to the position of ultimate plac-

ing and setting. But experience has shown that the best results in this respect have not been attained. The period of time after the water first comes in contact with the cement is an important factor, the setting or crystallizing beginning instantly upon such contact. And with hand-mixing devices it is impossible to attain the above described desirable and essential, intimate, and uniform mixing of the constituent parts and securing their proper distributive relation, it being well known to engineers that hand-mixed concrete masses have unavoidably incident to them numerous regions of improperly coated rock and of improperly mixed components. It is frequently necessary, and generally practised, to apply by brooms, or equivalent devices, an extra mass of grout-like water and cement before the mixing operation is regarded as completed. And, as concerns the mechanical mixers which handle the ingredients in relatively large masses, it is found that in order to effect the mixing rapidly enough the masses must be discharged before there has been the intimate and uniform commingling that is necessary. The above pointed out difficulties incident to the thorough mixing of the concrete constituents and to the complete coating of the rock pieces with binding material become especially serious when a relatively stiff mixture is made, that is one in which there is little or no excess of water beyond that necessary for causing crystallization. It is more or less common practice to add an excess quantity of water in order to insure at least approximately complete coating of the rock pieces in as short a time as possible. This excess quantity of water not needed for crystallization must of course evaporate before the concrete can reach its final dry condition. One of the important advantages incident to the use of a device embodying my invention is that this undesirable excess of water can be reduced to a minimum or entirely eliminated, satisfactory coating of the rock pieces being found to be possible when the binding material is relatively stiff. While an apparatus embodying my invention is especially well adapted for the handling of a mass of concrete forming elements containing little or no excess of water, it will be understood that its use is not limited to the handling of such a mass. It is equally well adapted for the treating and handling of a mass containing a considerable excess of water in case such an excess is for any reason found desirable. After the imperfect mixing attained in any of these earlier ways which have been mentioned the aim has been to transport the concrete from the place of mixing, (whether by barrows, mechanical conveyers, or other mechanism) to the place of its final deposit in such a way as not to destroy the original distributive relation of the constituent parts of the mass established in the mixer.

I have found that with a mechanism of the sort herein presented a very superior distributing and mixing of the ingredients can be obtained, even where a partially complete work of this sort has been effected preliminary to the introduction of the concrete into the chamber 1. The powerful jets of air or fluid agent are introduced through the pipe 10 as above described in such way as to insure a pressure in the discharge pipe and apply it to the concrete at points where, or near where, it escapes from the main receptacle. This causes the relatively large rock pieces, at the points where they commence their travel in the discharge pipe, to move with considerable violence in the general direction of the pipe toward the place of delivery, insuring that they shall be so agitated or relatively moved in the midst of the binding or cementing material that they shall be uniformly coated or covered with the latter, and, at the same time, the air is delivered in relation to the entire mass in such a way that components are not driven apart, or carried to different distances because of differences in specific gravity. But, while the apparatus which I have shown is adapted for the handling and the delivery in mixed condition of materials not initially mixed at the time of deposit in the chamber 1, I nevertheless do not herein claim as a part of my present invention the method of conveying and simultaneously mixing such initially unmixed materials. This subject-matter is presented and claimed in my co-pending application for mechanism and process for mixing and transporting concrete and similar materials, Serial No. 580,582, filed September 6, 1910. The best results are attained by having the delivery pipe of a relatively large diameter so that there shall be freedom for these relative movements of the rock particles and of the sub-masses that are forcibly impelled ahead of the air jet. The delivery pipe itself becomes a mixing chamber wherein pneumatic mixing is effected or continued, and, if this duct is of a size properly related to the other parts, and to the sizes of the particles of the materials, the latter can be rapidly impelled through it without danger of clogging or choking. The engineer, in any instance, will readily understand what the relative proportions of the parts should be; but I have found that for concrete with, as aforesaid, its masses of relatively large rock pieces, the diameter of the delivering and mixing pipe 13 should be from six to ten inches, the latter generally preferable, this being in contrast with the relatively small delivery tubes frequently used in pneumatic apparatus, and not designed, as described,

to permit such relative motions of large component particles as will insure perfect mixing. This action may be enhanced by providing one or more deflections in the path of the material, causing it, as an entirety, to be broken up, as, for instance, by the bend in the pipe at 14, which, as above described, also slightly checks the advancing mass or sub-masses to assist in preventing the water or other ingredients from separating from the general mass because of difference in specific gravity. All of the features of the invention, however, are not limited to the presence of such bends, as the same results can be attained by other ways now well known to engineers. The path for the material commencing with the points where it is initially introduced into the receptacle 1 and extending to the point of ultimate delivery, is, practically, entirely clear, that is to say, it is at no place provided with positively stopping projections, even at the bends in the delivery pipe, the path at the bends being of the same cross area as at other parts of the pipe; and consequently there are no points where a number of rock pieces can aggregate and choke the duct or commence to form a stoppage.

I am aware that it has been heretofore proposed to employ pneumatic apparatus for conveying each of many materials from point to point. This apparatus has included mechanism for conveying materials like grain and also pneumatic mechanism for transporting materials of a readily flowing or viscous consistency such as "grout", a composition all of whose particles are minute and easily commingled. The pneumatic propelling of these various materials has been effected through discharge pipes of relatively small diameter in which because of the fineness of the particles of material transported there was no danger of clogging, and which were not intended to be used as mixing chambers for the material in transit. None of these forms of mechanisms were found available for the treating of concrete, because of the reasons above explained, and up to the time of my invention no mechanisms for handling concrete were in use.

It will be seen that the receptacle 1 is not only practically unobstructed, as above described, but is so constructed that the material is gradually guided or directed to the large discharge pipe, this guidance being effected by the walls of the receptacle, which join the duct walls with substantial smoothness. This is a matter of great importance where pneumatic pressure is depended on to effect the discharge. The pressure is initially applied over a relatively large top surface and although but a limited part of this pressure surface is effective in driving the material along the discharge tube, (namely, that on a central column of about the same cross area as the discharge tube) the pressure upon the marginal part of the mass top surface acting in conjunction with the converging walls of the conical bottom compels the entire mass to press toward the center and to escape into the pipe with great rapidity and force. And in this respect the mechanism is contradistinguished from those in which discharge pipes are connected with relatively flat wall parts of materials containing receptacles.

Although I have illustrated the apparatus for elevating material, as would be required where concrete is to be delivered to the upper floors of a building under construction, it is apparent that the invention is of advantage for transporting material along a level, as in the construction of bridges, tunnels, etc.

Having described my invention, what I claim and desire to secure by Letters Patent, is:—

1. In combination, a chamber for containing concrete forming materials, a conduit leading therefrom, and having its walls joining the chamber walls with substantial smoothness, and two compressed air inlet pipes connected to the chamber, one of them terminating in a nozzle inside the chamber directed toward the opening into the said conduit and the other pipe opening into the chamber at a point remote from said nozzle.

2. In combination, a chamber for containing concrete forming materials, a conduit leading therefrom, a compressed air inlet pipe connected to a part of the chamber remote from the conduit, and another compressed air inlet pipe leading through the chamber wall and terminating within the chamber near the opening into the conduit in a nozzle directed toward said opening.

3. The method of conducting concrete forming materials through a closed conduit, which consists in introducing the materials in a mass into a chamber connected to said conduit, introducing relatively compressed air behind the whole mass and behind a front portion thereof, and thereby detaching successive portions and driving them from the chamber into the conduit and along the latter.

4. The method of conducting concrete forming materials from a receptacle along a closed conduit connected therewith to the place where it is to be utilized, which consists in closing the receptacle, introducing compressed air behind the mass of materials and also behind the portion thereof lying adjacent the conduit, and thereby pushing the mass into and along the conduit.

5. The herein described method for treating and conveying a relatively compact and impervious mass of concrete forming materials, which consists in violently ejecting

the mass from a chamber into and through a relatively large continuous duct by means of a pressure agent applied behind the mass and a pressure agent introduced into the mass in the general direction of motion thereof at a point along its path.

6. The herein described method of treating and conveying a relatively compact and impervious mass of concrete forming materials which consists in positioning the mass in a chamber connected with an extended outlet passageway, applying air pressure behind the mass within the chamber to force it toward the outlet passageway, and injecting a jet of air under pressure into the mass at an angle to the line of movement of the mass into and through the said passageway.

7. The herein described method of treating and conveying a mass comprising rock, sand, cement and water in concrete forming proportions, which consists in positioning the mass in a chamber having a relatively large cross sectional area and connected with an extended passageway having a smaller cross sectional area, applying to the mass within the chamber air pressure for the purpose of propelling the mass toward and into the said extended passageway, and injecting into the mass at a point adjacent the connection between the chamber and passageway a jet of air so directed as to mingle with the mass and aid its movement along the said passageway.

8. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in positioning the mass in a chamber which is connected with a relatively extended passageway, applying air pressure to the mass in the chamber to force it toward and into the passageway in a compact stream, and injecting into the stream at a point along its path, and in the general direction of its movement a jet of air which has a small cross sectional area as compared with that of the stream.

9. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in applying air pressure to the mass to eject it from a chamber into a passageway, maintaining the mass in a compact stream as it approaches the entrance to the passageway, and at a point along its path into and through the passageway injecting into the mass a jet of air at an angle to the line of movement along the said path, the cross sectional area of the said jet being small as compared with that of the stream.

10. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in positioning the mass in a chamber having a relatively large cross sectional area, applying air pressure to the mass to eject it from the chamber into a relatively extended passageway having a smaller cross sectional area, maintaining the mass in a compact stream as it approaches the entrance of the said passageway, and injecting into the mass at a point adjacent the point of communication between the chamber and the passageway a jet of air for the purpose of aiding the movement of the mass along the passageway, the cross sectional area of the said jet being small as compared with that of the stream.

11. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in feeding the mass in a compact stream, and subjecting successive portions of the stream to the action of an air jet so directed as to aid the movement of the successive portions along a relatively extended pathway, the cross sectional area of the said jet being small as compared with the cross sectional area of the stream.

12. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in subjecting successive portions of the mass at the bottom of a relatively large mass body to the action of a jet of air so directed as to aid the movement of said portions along an extended pathway.

13. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in subjecting successive portions of the mass at the bottom of a relatively large mass body to a jet of air so directed as to aid in causing the movement of the said portions away from the said main mass body and guiding the said portion along a path which, at points adjacent the said jet, is at an angle thereto.

14. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in subjecting successive portions of the mass to the action of a jet of air moving at high velocity, and subjecting the main body of the mass to air under pressure for the purpose of advancing the mass gradually into the range of action of the said velocity jet.

15. The herein described method of treating and conveying a mass of rock, sand, cement and water in concrete forming proportions, which consists in subjecting successive portions of the mass to the action of a jet of air moving at high velocity, and subjecting the main body of the mass to pressure for the purpose of advancing the mass gradually into the range of action of the said velocity jet.

16. In a conveyer, a chamber, a receiver, a removable seal between the receiver and the chamber, a discharge pipe connected with said chamber, a pressure pipe connected with the chamber, and a water pipe connected with the chamber.

17. In a device for treating and moving a mass of concrete forming materials, the combination of a chamber for receiving and containing the said mass, a discharge duct connected with the chamber, an air inlet pipe connected with the chamber, means for preventing the flow of air or materials out of the chamber except through the discharge duct, means for supplying air under pressure through the said pipe to the chamber back of the mass of materials therein to push the said mass toward and into the discharge duct, and means for causing a jet of air to impinge upon successive portions of the mass in the general direction of the discharge duct to directly assist their movement therethrough.

18. In a device for treating and moving a mass of concrete forming materials, the combination of a chamber for receiving and containing the said mass, a discharge duct connected with the chamber and extending to a discharge point in a horizontal plane above the chamber, an air inlet pipe connected with the chamber, means for preventing the flow of air or materials out of the chamber except through the discharge duct, means for supplying air under pressure through the said pipe to the chamber back of the mass of materials therein to push the said mass toward and into the discharge duct, and means for causing a jet of air to impinge upon successive portions of the mass in the general direction of the discharge duct to directly assist their movement therethrough.

19. In a device for treating and moving a mass of materials for forming concrete, the combination of a receiver, a removable seal connected with the receiver, a chamber with which the receiver communicates when the seal is removed, a discharge duct connected with the chamber, and having a substantially unbroken inner surface, the said chamber having walls which gradually converge on all sides to the duct and join the duct walls with substantial smoothness, and means for supplying a pressure agent both to the chamber back of a mass of materials therein and to the discharge duct.

20. In a device for treating and delivering materials for forming a concrete mass, the combination of a chamber for the said materials, a relatively large discharge duct having an unobstructed interior and unobstructed communication with the chamber, the chamber having walls which gradually converge on all sides toward the discharge duct, and join the duct walls with substantial smoothness, and means for delivering a pressure agent to the chamber behind the mass of concrete materials therein.

21. In a device for treating and moving a mass of concrete forming materials, the combination of a chamber adapted to receive and contain the said mass, a discharge duct connected with the chamber, the said chamber having walls which gradually converge on all sides to the duct, and join the duct walls with substantial smoothness, means for supplying a fluid pressure agent to the chamber back of a mass of materials contained therein, and means for directing a fluid pressure agent into the discharge duct in the general direction thereof.

22. In a device for treating and moving a mass of ingredients for forming concrete and containing relatively large pieces of material, the combination of a relatively large discharge duct, a pressure chamber for receiving the said ingredients of the concrete mass, said chamber having walls which gradually converge to the discharge duct and join the duct walls with substantial smoothness, the parts being arranged to have pressure exerted upon the material within the discharge duct from the surface of the mass in the chamber on lines extending directly into the discharge duct.

23. In a device for treating and moving a mass of materials for forming concrete, the combination of a receiver, a chamber, a removable seal between the receiver and the chamber, a discharge duct connected with the chamber, the said chamber having walls which gradually converge on all sides to the duct and join the duct walls with substantial smoothness, and means for delivering a pressure agent to the chamber back of a mass of materials therein to assist the movement of the said mass into and through the said discharge duct.

24. In a device for treating and moving a mass of concrete forming materials, the combination of a chamber adapted to receive and contain the said mass, a discharge duct connected with the chamber and extending from it to a discharge point in a horizontal plane above the chamber, and means for directing a pressure agent into the discharge duct in the general direction thereof to engage sub-masses of the materials and aid their movement through the duct to the discharge point.

25. In a device for treating and moving a mass of concrete forming materials, the combination of a receiver, a charge containing chamber connected with the receiver, a removable seal between the receiver and the chamber, a discharge duct connected with the chamber, and means for directing a jet of elastic fluid under pressure into the discharge duct in the general direction thereof to engage succesive portions of the said mass

and their movement into and through the said duct.

26. In a device for treating and moving a mass of concrete forming materials, the combination of a chamber adapted to receive and contain the said mass, a discharge duct connected with the chamber, the said chamber having walls converging to the duct, means for directing a jet of elastic fluid under pressure into the discharge duct in the general direction thereof to engage successive portions of the said mass to aid their movement through the said discharge duct, and means for supplying water to the mass in the chamber as it enters the discharge duct.

27. In a device for treating and delivering a mass of materials for forming concrete, a chamber for the said materials, a discharge duct, the walls of the chamber converging gradually on all sides to the discharge duct and joining the duct walls with substantial smoothness, and the path from the chamber into and through the duct being entirely clear, and means for moving the materials from the receptacle into and through the discharge duct along straight lines extending directly from the chamber into the discharge duct.

28. In a device for treating and delivering a mass of materials for forming concrete, the combination of a chamber, a discharge duct communicating with the chamber, a pipe for delivering a jet of fluid pressure agent for propelling the said concrete materials, a manually controllable valve in the said pipe, the said pipe being arranged with its receiving end outside of the said receptacle and with its delivery end outside of the discharge duct but adapted to deliver the jet of fluid agent to the interior thereof, the interior of the said discharge duct being thus left substantially unobstructed.

29. In a device for the treatment and transportation of concrete forming materials, the combination of a chamber for the said mass, a discharge duct connected with the chamber, the chamber walls joining the duct walls with substantial smoothness, and a means for supplying a jet of fluid pressure agent in the general direction of the duct at a point adjacent its point of connection with the chamber to engage sub-masses of materials to assist their movement through the duct.

30. In a device for treating and delivering a mass of ingredients for forming concrete, the combination of a chamber for receiving and containing the said ingredients of the concrete, a discharge duct connected therewith, the said chamber having walls which gradually converge on all sides to the duct and join the duct walls with substantial smoothness, an air pipe for delivering air or equivalent fluid agent under pressure to the interior of the discharge duct on lines inclined to the longitudinal lines of the discharge pipe and inclined to an axial line of the chamber, and a manually controllable valve in the said air pipe.

31. In a device for treating and transporting concrete forming materials, the combination of a chamber for receiving and containing a mass of the said materials, a discharge duct leading from the chamber, the said chamber having walls which gradually converge on all sides to the duct and join the duct walls with substantial smoothness and the path from the chamber into and through the duct being entirely clear, the duct being provided with a bend at a point adjacent the chamber, and means for directing a jet of fluid pressure agent into the duct along lines cutting the path of materials through the bend thereof to engage sub-masses of the said materials to assist their movement.

32. In a device for the treating and transporting of concrete forming materials, the combination of a chamber for containing a mass of the said materials, a duct leading from the chamber, the chamber having walls which gradually converge on all sides to the duct and join the duct walls with substantial smoothness, thesaid duct being provided with a bend, means for directing a jet of fluid pressure agent into the duct along line cutting the path of materials through the bend thereof to engage sub-masses of the said materials and assist their movement, and additional means tending to cause the movement of the materials from the chamber into the duct.

33. In a device for treating and moving a mass of concrete forming materials, the combination of a chamber adapted to receive and contain the said mass, a discharge duct connected with the chamber, the said chamber having walls converging on all sides to the duct, means for supplying a pressure agent to the chamber back of a mass of materials contained therein, means for directing a pressure agent into the discharge duct, and means for supplying water to the mass in the chamber as it enters the discharge duct.

34. In a device for treating and moving a mass of concrete forming materials, the combination of a chamber adapted to receive and contain the said mass, a discharge duct connected with the chamber, the said chamber having walls which gradually converge on all sides of the duct and join the duct walls with substantial smoothness, manually controllable means for supplying a fluid pressure agent to the chamber back of a mass of materials contained therein, and manually controllable means for directing a fluid pressure agent into the discharge duct in the general direction thereof.

35. In a device for treating and moving a mass of concrete forming materials, the

combination of a chamber adapted to receive and contain the said means, a discharge duct connected with the chamber, the said chamber having walls which gradually converge on all sides of the duct and join the duct walls with substantial smoothness, manually controllable means for supplying a fluid pressure agent to the chamber back of a mass of materials contained therein, and means manually controllable independently of the aforesaid means for directing a fluid pressure agent into the discharge duct in the general direction thereof.

In testimony, that I claim the foregoing as my own I affix my signature, in presence of two witnesses.

JOHN H. McMICHAEL.

Witnesses:
CARL H. KELLER,
M. A. TRACEY.

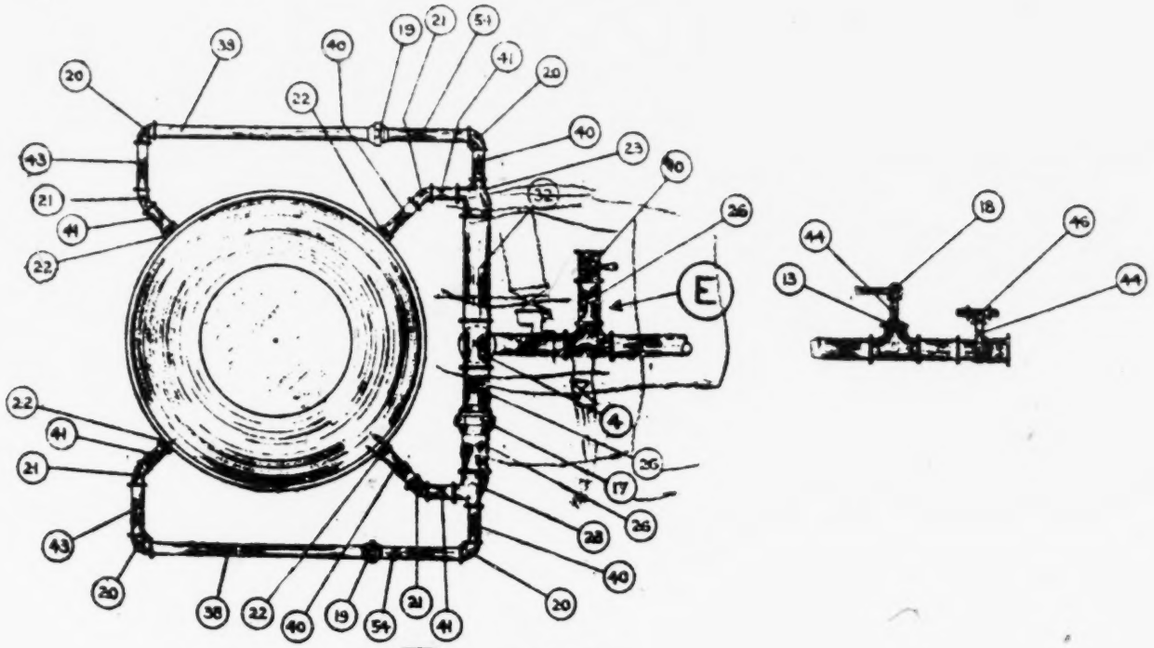
PLAINTIFF'S EXHIBIT No. 3

PLAINTIFF'S EXHIBIT No. 4

ASSEMBLY DRAWING
TYPE "A"
PNEUMATIC MACHINE

PNEUMATIC CONCRETE MACHINERY CO.
NEW YORK

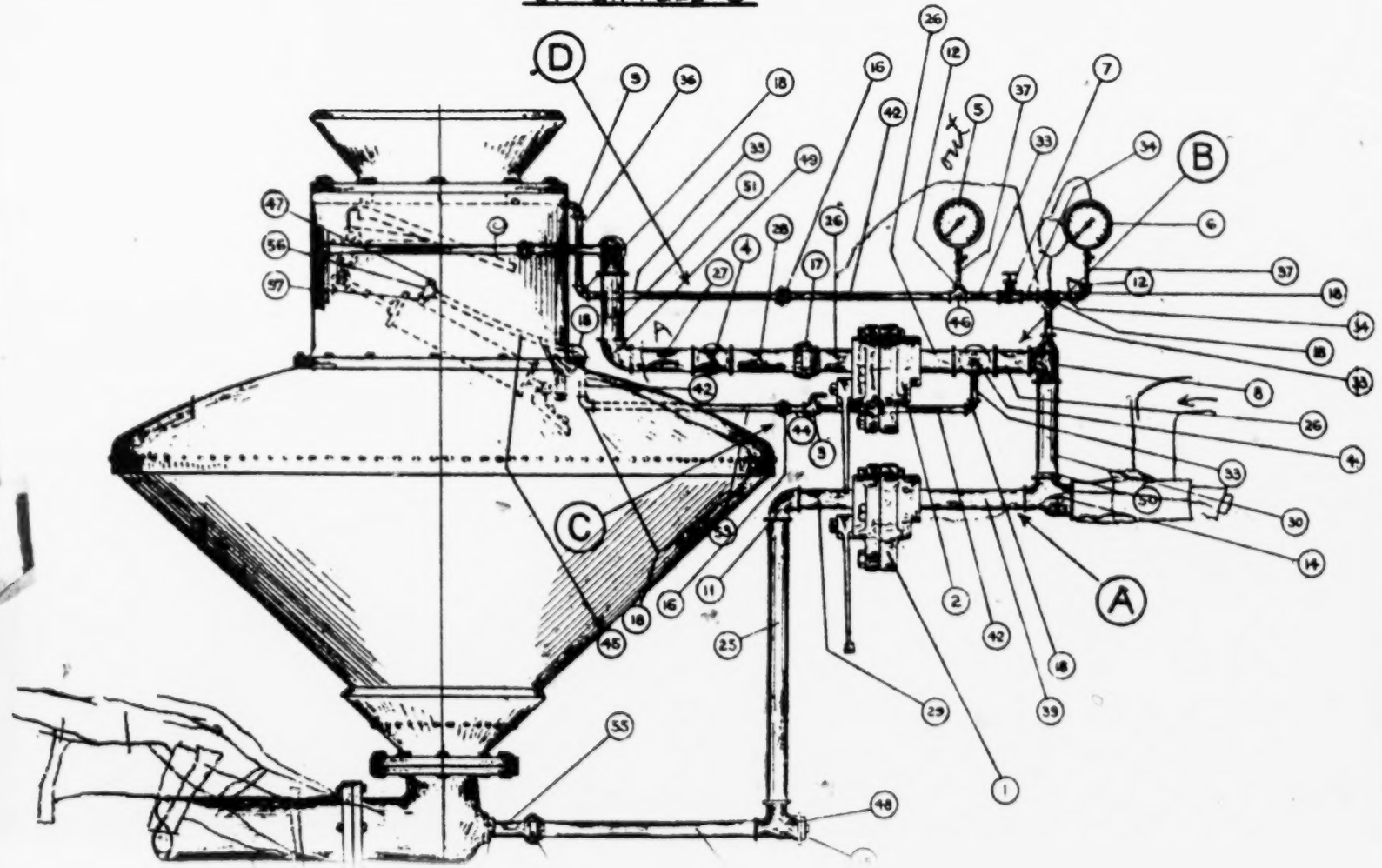
SCALE 1" = 1'-0" CHECKED
DRAWN APP'D
TRACED DATE 5-17-20
PRELIMINARY
REVISED No. PN 40



PLAN

SE

MANIFOLD CONNECTIONS TO DOME
UPPER FEED "B"

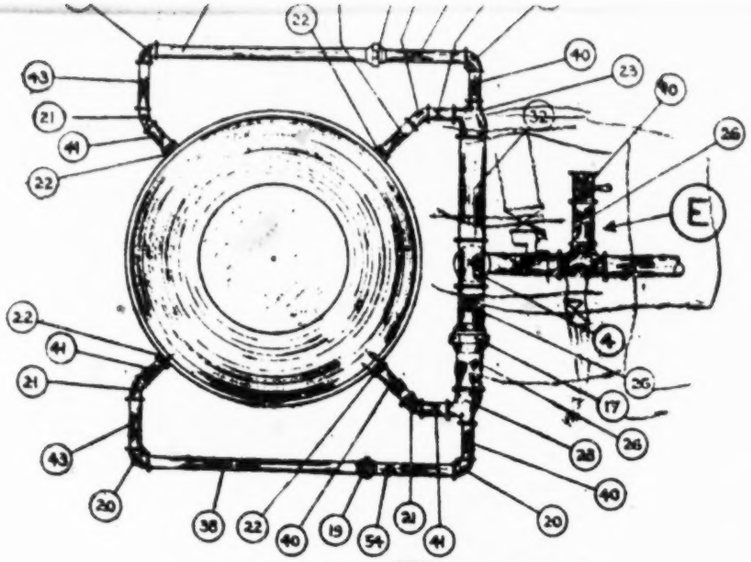


No.	Quan.	TYPE
1	1	2" EVERLASTING VALVE
2	1	1½" " "
3	1	½" 3 WAY PLUG COCK
4	3	1½" TEES
5	1	6" PRESSURE GAUGE
6	1	6" " "
7	1	½" GLOBE VALVE
8	1	1½"x½"x1½" TEE
9	1	½" STREET ELBOW
10	1	1½" PLUG COCK
11	1	2" ELBOW
12	2	½"x¼" BUSHINGS
13	1	1½"x½" "
14	1	2"x3"x2" TEE
15	1	2" PLUG
16	2	½" UNIONS
17	2	1½" "
18	7	½" ELBOWS
19	2	¾" UNIONS
20	4	¾" ELBOWS
21	4	¾" 45° "
22	4	1¼"x¾" BUSHINGS
23	2	1½"x¾"x¾" TEES
24	1	2"x21¼" NIPPLE
25	1	2"x27¼" "
26	6	1½"x4" "
27	1	1½"x6⅝" "
28	1	1½"x7¼" "
29	1	2"x5" "
30	1	1½"x10½" "
31	1	2"x2½" BUSHING
32	1	1½"x9¼" NIPPLE
33	2	½"x4" "
34	1	½"x3" "
35	1	½"x20" "
36	1	½"x4" "
37	2	¼" CLOSE "
38	2	¾"x18¼" "
39	1	2"x10½" "
40	2	¾"x3¾" "
41	4	¾"x3¼" "
42	3	½"x4" "
43	2	¾"x4¾" "
44	3	½" CLOSE "
45	1	¼"x18" RUBBER HOSE (4 CLAMPS FOR SAME
46	2	½" TEES
47	1	⅜" PLUG
48	1	2" TEE
49	1	1½" ELBOW
50	1	2"x1½" BUSHING
51	1	1½"x6" NIPPLE
52	1	2" UNION
53	1	½"x18" NIPPLE
54	2	¾"x6¾" "
55	1	2"x4" "

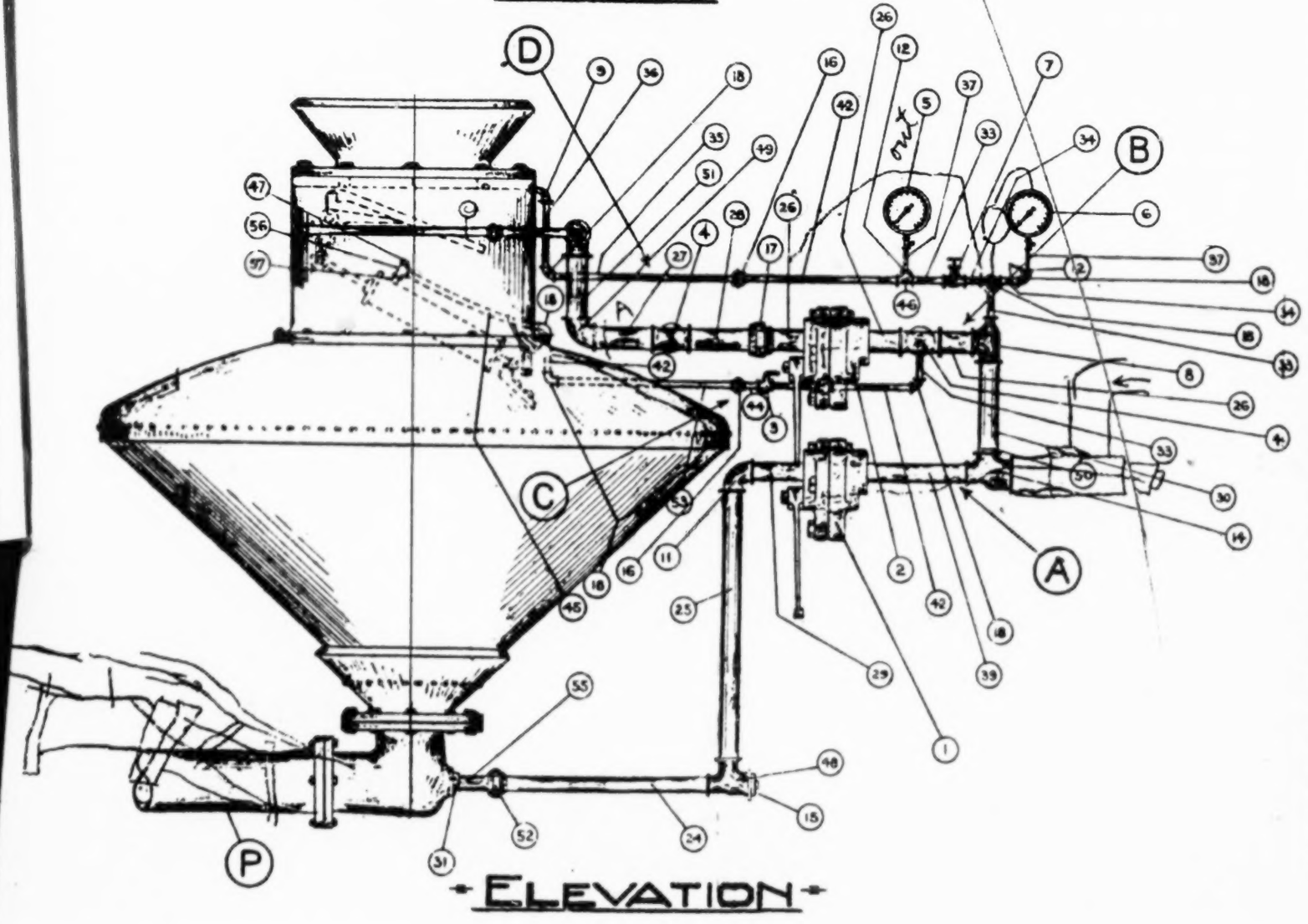
ASSEMBLY DRAWING
TYPE "A" PNEUMATIC MACHINE

PNEUMATIC CONCRETE MACHINERY CO.
NEW YORK

SCALE 1½" = 1'-0"
DRAWN
TRACED
PRELIMINARY
REVISED
CHECKED
APP'D
DATE 5-17-20
No. PN 40



PLAN
OF
MANIFOLD CONNECTIONS TO DOME
UPPER FEED "B"



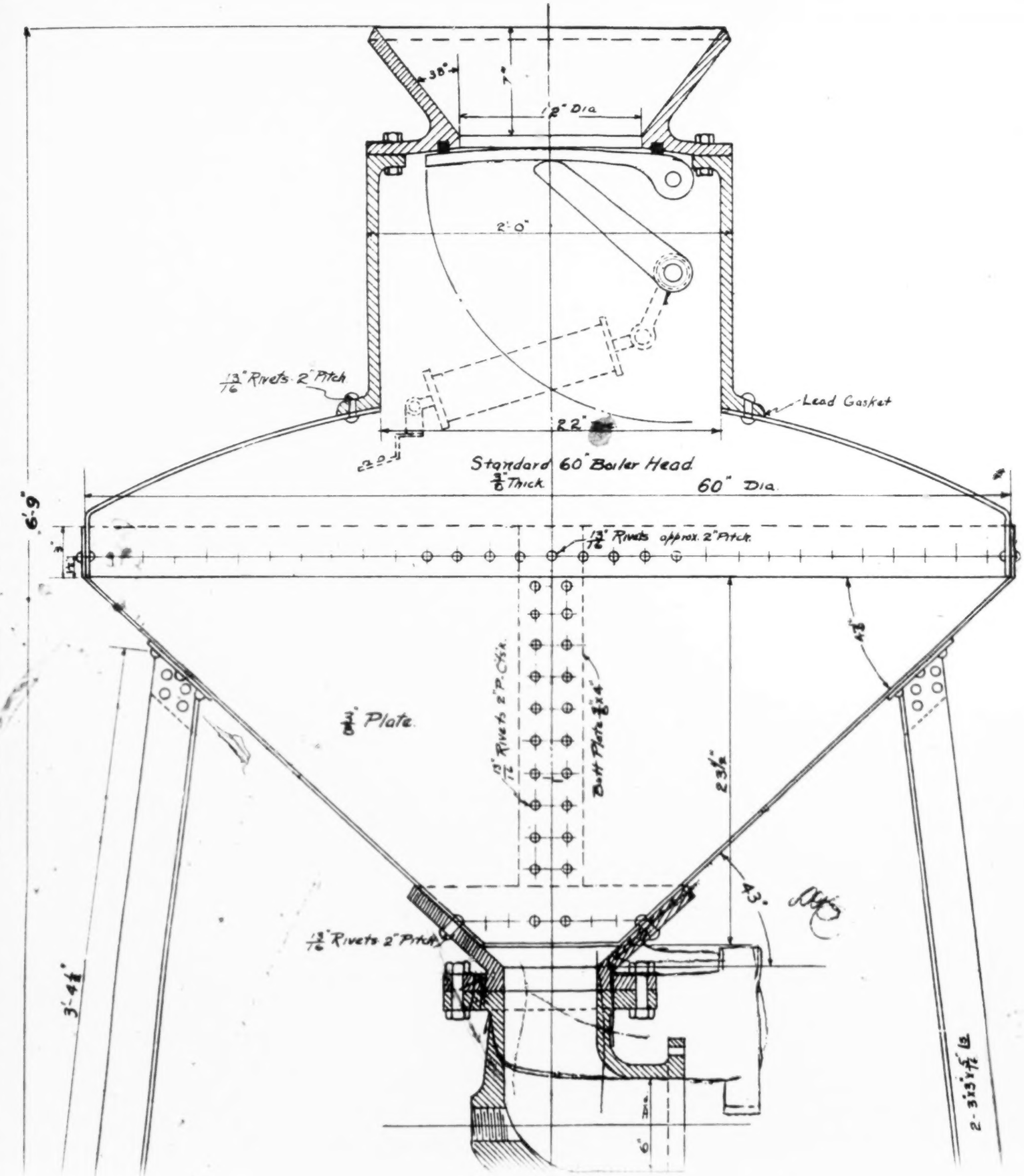
ELEVATION

No.	Quantity	Type
1	1	2" Everlasting Valve
2	1	1½" " "
3	1	½" 3 Way Plug Cock
4	3	1½" Tees
5	1	6" Pressure Gauge
6	1	6" " "
7	1	½" Globe Valve
8	1	1½"x½"x1½" Tee
9	1	½" Street Elbow
10	1	1½" Plug Cock
11	1	2" Elbow
12	2	½"x¼" Bushings
13	1	1½"x½" "
14	1	2"x3"x2" Tee
15	1	2" Plug
16	2	½" Unions
17	2	1½" "
18	7	½" Elbows
19	2	¾" Unions
20	4	¾" Elbows
21	4	¾" 45° "
22	4	1¼"x¾" Bushings
23	2	1½"x¾"x¾" Tees
24	1	2"x 21¼" Nipple
25	1	2"x 27½" "
26	6	1½"x 4" "
27	1	1½"x 6⅜" "
28	1	1½"x 7¼" "
29	1	2"x 5" "
30	1	1½"x 10½" "
31	1	2"x 2½" Bushing
32	1	1½"x 9¼" Nipple
33	2	½"x 4" "
34	1	½"x 3" "
35	1	½"x 20" "
36	1	½"x 4" "
37	2	¼" Close "
38	2	¾"x 18¼" "
39	1	2"x 10½" "
40	2	¾"x 3¾" "
41	4	¾"x 3¼" "
42	3	½"x 4" "
43	2	¾"x 4¾" "
44	3	½" Close "
45	1	¾"x 18" Rubber Hose (4 Clamps for Same)
46	2	½" Tees
47	1	⅜" Plug
48	1	2" Tee
49	1	1¼" Elbow
50	1	2"x 1½" Bushing
51	1	1½"x 6" Nipple
52	1	2" Union
53	1	½"x 18" Nipple
54	2	¾"x 6¾" "
55	1	2"x 4" "
56	1	⅜"x ⅜"x ½" Tee
57	1	⅜" Close Nipple

29½

383

PLAINTIFF'S EXHIBIT No. 5



ASSEMBLY D'W'G. Pneumatic Machines.	
PNEUMATIC CONCRETE MACHINERY CO. 6 RECTOR ST. NEW YORK.	
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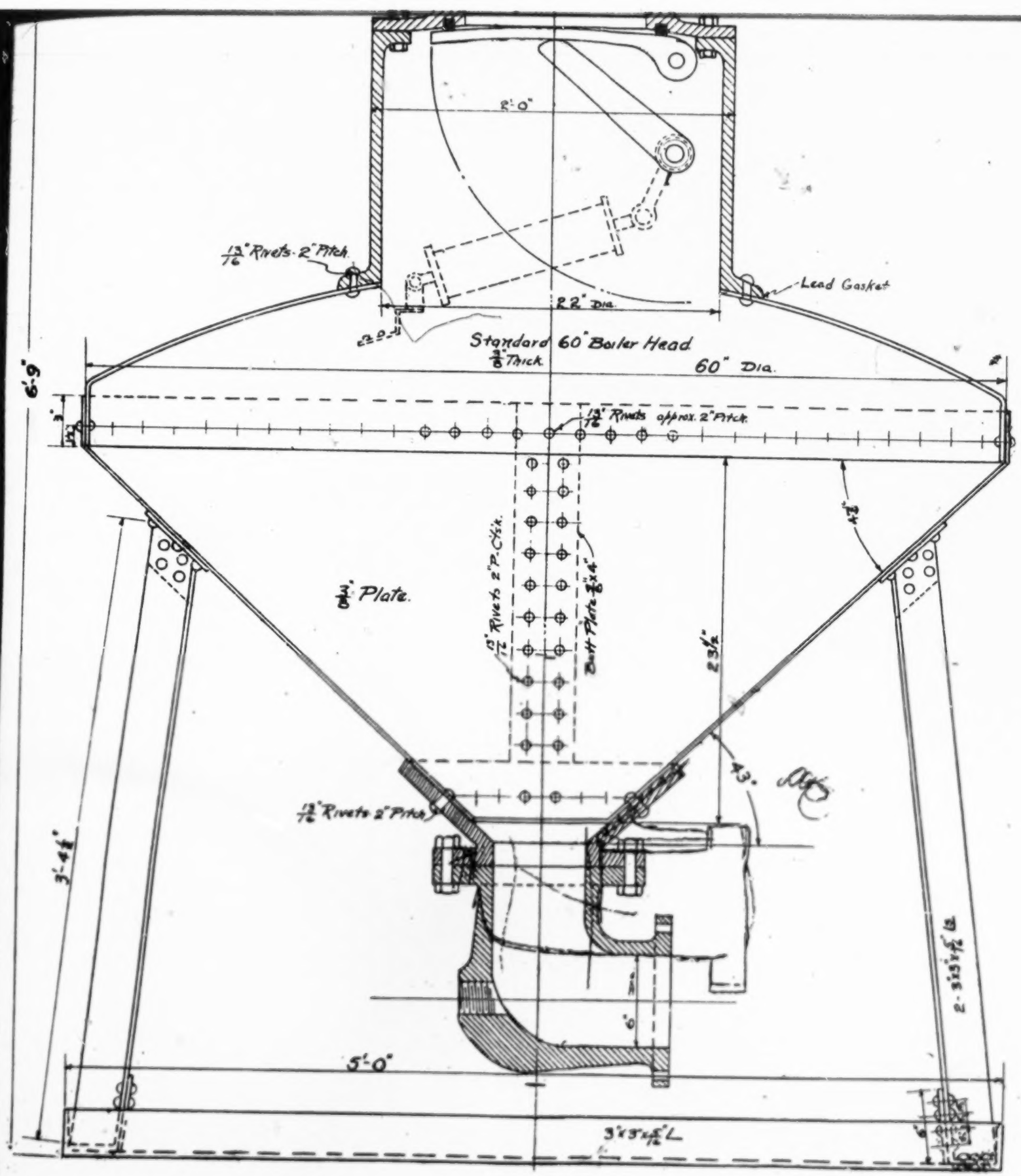
DRAWN A.G.F.	APPR'D A.G.Fleck
TRACED R.R.D.	DATE
PRELIMINARY	No.
REVISED	



ASSEMBLY D'W'G.
Pneumatic Machine.

PNEUMATIC CONCRETE MACHINERY CO.
2 RECTOR ST. NEW YORK.

SCALE Full
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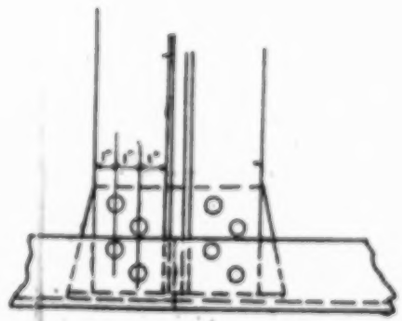
TRACED A.G.F. APPRD A.G.Fisher
PRELIMINARY DATE
REVISED No.



[fol. 384] PLAINTIFF'S EXHIBIT No. 19

(P. 13)

Item 6. For concrete masonry, in place, the sum of nineteen and 00/100 dollars ($19.00) per cubic yard.

Item 6-S. For rubbing to a smooth finish the surface of concrete as required by Section No. 175, the sum of Fifteen cents ($0.15) per square foot.

Item 7. For protective concrete masonry, in place, outside of waterproofing, the sum of Fifteen and 55/100 dollars ($15.55) per cubic yard.

Item 8. For rubble stone masonry, in place, the sum of Nine and 45/100 ($9.45) dollars per cubic yard.

Item 8-A. For dry rubble masonry, in place, the sum of Nine and 00/100 dollars ($9.00) per cubic yard.

Item 9. For brick masonry, in place, the sum of Thirty-nine and 00/100 dollars ($39.00) per cubic yard.

Item 10. For hollow terra cotta brick or tile masonry of any thickness, in place, the sum of thirty-six and 00/100 dollars ($36.00) per cubic yard.

Item 10-A. For four and one-half (4½) inch by thirteen (13) inch terra cotta flue lining, in place, the sum of One and 50/100 dollars ($1.50) per lineal foot of flue.

Item 11. For grout of Portland cement, the sum of Six and 00/100 dollars ($6.00) per barrel of Portland cement used.

[fol. 385] (Pp. 102 and 103)

160. One barrel of cement shall consist of four bags, each bag containing 94 pounds net of cement, and 94 pounds of cement shall be estimated at 0.875 cubic foot of volume.

For the purpose of measuring and mixing ingredients for concrete the unit of volume shall be 0.875 cubic foot.

Each and every batch of concrete mixed shall contain one unit of volume of cement, or multiples thereof.

Fine and coarse aggregates shall be measured separately on the work before mixing. No mixture of course and fine aggregates will be permitted to be delivered to the Works.

The proportion of coarse and fine aggregates shall be measured by volume as cast into the measuring boxes, and struck measures shall be used. The Contractor shall pro-

vide separate, strong, substantial measuring boxes, approved by the Engineer, the capacities of which shall be in the specified proportion to the volume of cement as defined above, and such boxes shall be used for each and every batch.

The volume of water used in concrete shall be exactly gauged for each and every batch, and the Contractor shall provide approved accurate measuring and controlling devices therefor. The concrete shall be of a plastic consistency, the amount of water to be used shall be determined by the Engineer.

161. Whenever practicable, concrete shall be machine mixed. A rotary machine of a pattern approved by the Engineer, and mixing only one batch at a time, shall be [fol. 386] used. The time of mixing each batch of concrete after all the ingredients are in the mixer shall be determined by the Engineer for each type of machine, but the minimum time for any type of machine shall be (1) one minute. Concrete shall not be mixed on the surface of the street or decking on the line of the work, unless specifically permitted, but the mixing shall be done as close as practicable to the work so as to avoid too great a lapse of time between the mixing and placing of the concrete in the forms.

162. When concrete is mixed by hand the coarse aggregate shall be spread on a platform in a bed about six (6) inches thick, and shall be thoroughly wet. Fine aggregate shall be spread on a platform and the cement spread on the fine aggregate. After thoroughly mixing the cement and fine aggregate, the dry mixture thus formed shall be spread evenly over the bed of coarse aggregate wet as above, and the whole turned over until thoroughly mixed, but not less than four (4) turnings on the mixing board will be allowed in any case, water being added gradually. Care shall be taken to keep the bed of concrete wet and avoid piling.

163. Concrete shall be placed immediately after mixing, in layers of such thickness as may be directed by the Engineer and shall be thoroughly compacted throughout the mass by ramming or spading, special tamping bars or tools being used as approved by the Engineer. If a small amount of water has been used in mixing, ramming shall be continued until the water flushes to the surface.

UNITED STATES PATENT OFFICE.

WILLIAM HARROLD SMITH, OF NEW YORK, N. Y.

IMPROVEMENT IN CONCRETE PAVEMENTS.

Specification forming part of Letters Patent No. 122,497, dated January 2, 1872.

To all whom it may concern:

Be it known that I, WILLIAM HARROLD SMITH, of the city, county, and State of New York, have made new and useful Improvements in Concrete for Pavements and other purposes; and I do hereby declare the following to be a full, clear, and exact description of the same.

In an application filed by me contemporaneously herewith for Letters Patent of the United States I have described certain improved machinery and appliances for manufacturing and mixing concretes for pavements, buildings, and other purposes, conveying it from the machine to the place where it is to be laid or used, and suitably laying or casting it in molds or otherwise to the required form. By reference to the specification filed therewith it will appear that such apparatus is specially adapted to the manufacture and use of a liquid or semi-liquid concrete composition which can be conveyed through pipes and cast in molds. No concrete composition has ever been brought into public use for the purposes referred to which is capable of being thus manipulated; nor has it been deemed practicable to attempt to invent a composition sufficiently liquid to flow freely through pipes and yet able to set quickly upon reaching its destination, so as to form in a very short time a solid mass of artificial stone. Such a composition, however, I have discovered, and have proved, by a thorough course of experiments and trials, its complete fitness for the purposes and the great practical utility of its application in the manner referred to. So far, therefore, as relates to this division of the subject-matter contained in my several applications for Letters Patent, my invention consists in a composition prepared substantially as hereinafter described, so as to be capable of use in a fluid or semi-fluid condition, for the purposes specified.

I take any good hydraulic cement, preferably Portland cement, and sand, gravel, or some equivalent of sand or gravel, such as broken shells, slag, etc., and mix them together in about equal proportions by specific weight. This mixing may be accomplished by any suitable means, but preferably by the machine described in my other application above referred to. To the mixture of cement and sand, in the proportion of two parts, by weight, I add three parts, by weight, of broken stone, using therefor any of the varieties of stone suitable for the purpose, such as blue-stone, quartz, the ordinary cobble-stones employed for paving purposes, granite, &c. I then add a quantity of water equal to about three-fifths of the entire mass of materials already commingled, and agitate the mixture thoroughly by mechanical means until the whole is of a fluid character, capable of flowing freely through pipes and of being run into covered molds. It is then ready for use.

It will be seen from what I have stated that the materials employed by me in making this improved composition are old, every one of them having been used for many years. My invention does not consist in being the first to combine such materials, but in being the first to combine them for the arts in such proportions that a liquid or semi-liquid mass results which can be flowed through pipes and run into covered molds, and which can be made and used in laying pavements, building houses and other structures, etc., by means of the improved machinery described in my said accompanying application.

I do not claim to cover a pasty mass which can be pressed into blocks but which will not flow through pipes, the great practical advantage of my improvement being the adaptation of the material to a new method of conveying and laying it for the purposes set forth.

The proportions above stated may be varied within certain limits without departing from the spirit of my invention. However they may be varied, so long as the result is a composition which will flow through pipes or run into molds, it comes within the scope of my claims. Indeed, with certain species of stone of different specific gravities, the proportions of sand, water, and cement must necessarily be slightly varied. The heavier the stone the more dense must be the surrounding liquid in order to sustain it. The broken stone must be held uniformly diffused throughout the mass, and the liquid, while thin enough to flow even with the stones intermingled, must be thick enough or have tenacity enough to keep the stones from

settling to the bottom. In the perfect adjustment of these conditions consists the great secret of my success.

So far as concerns the process of laying pavements and building up walls by carrying the materials in a liquid form in tubes and discharging it therefrom into molds which keep it in the required position until it is set, such process is claimed in my contemporaneous application and constitutes no part of this. Such process is applicable to all compositions, however made and whether yet discovered or not, that can be conveyed in pipes.

Having thus described my invention, what I claim is—

The paving or building composition herein described, when prepared for use in a liquid or semi-liquid condition, capable of flowing in pipes and running into molds, substantially as described.

W. HARROLD SMITH.

Witnesses:
NATHAN K. ELLSWORTH,
MELVILLE CHURCH. (110)

(40.)

3 Sheets--Sheet 1.

W. H. SMITH.

Improvement in the Manufacture of Concrete Pavement and Machinery for same.

No. 122,498. Patented Jan. 2, 1872.

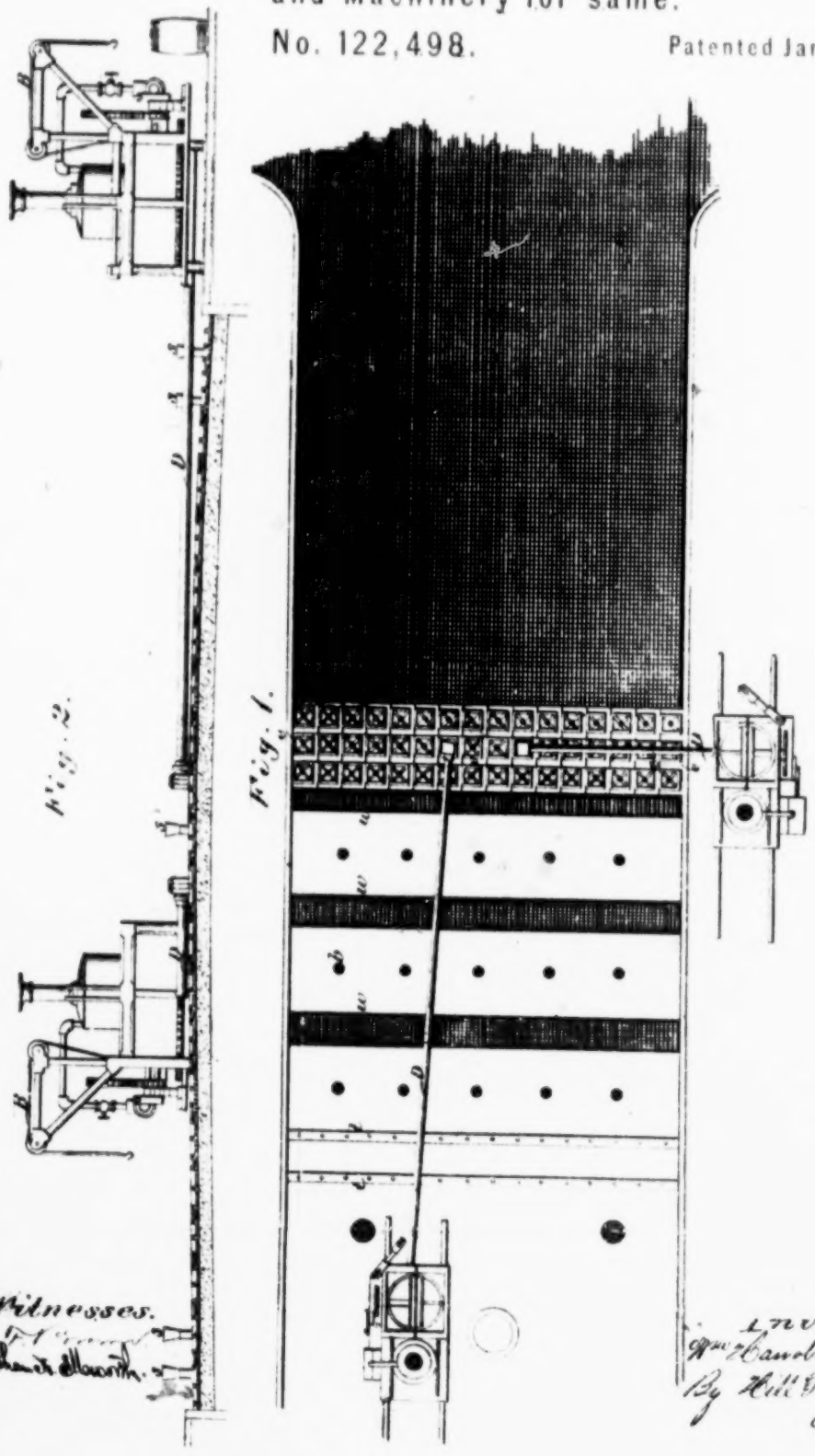


Fig. 1.

Fig. 2.

Witnesses.

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Wm. Harold Smith
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3 Sheets--Sheet 2.

W. H. SMITH.

Improvement in the Manufacture of Concrete Pavement and Machinery for same.

No. 122,498. Patented Jan. 2, 1872.

Fig. 3.

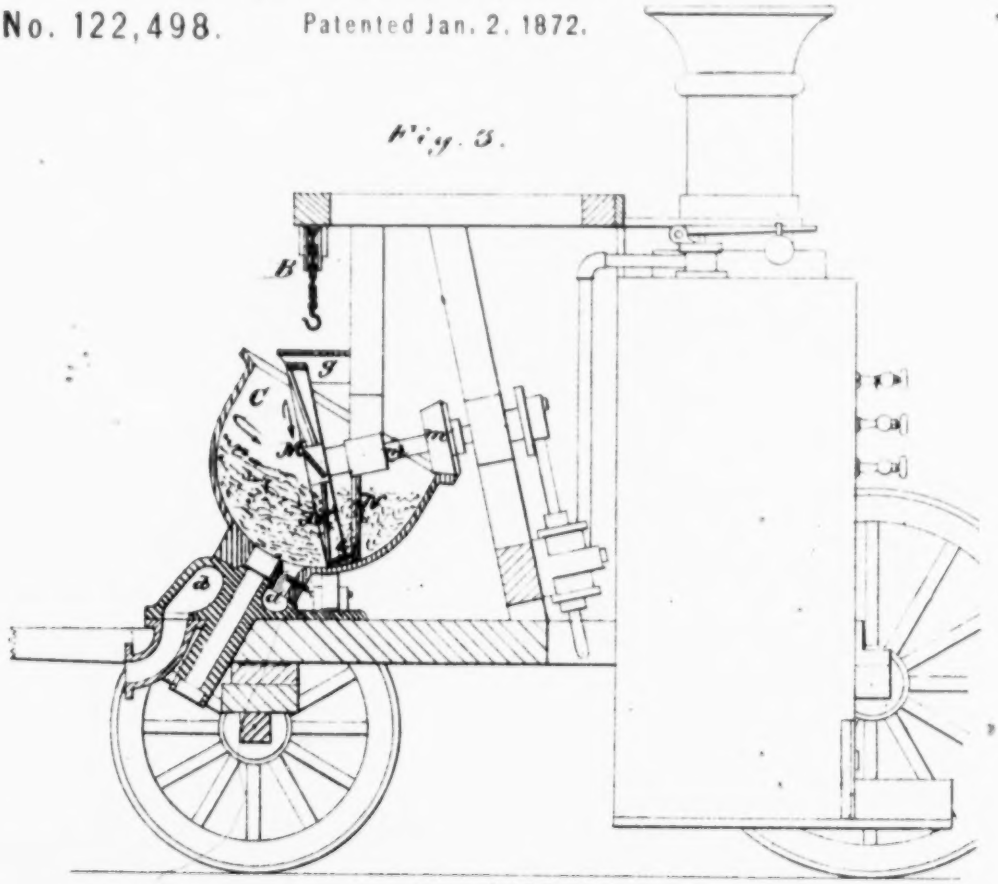
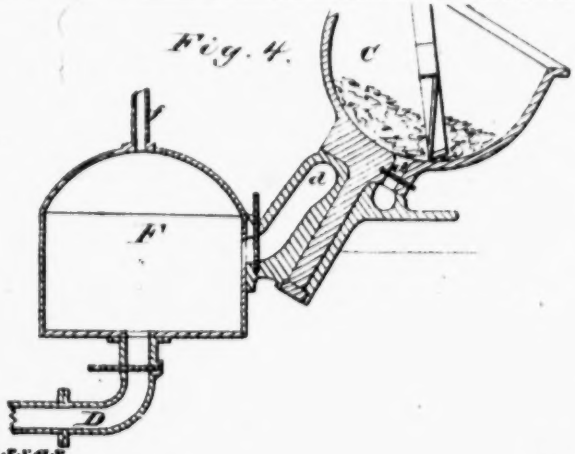


Fig. 4.



Witnesses.

Nathan R. Ellsworth.

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(40.) 3 Sheets--Sheet 3.

W. H. SMITH.

Improvement in the Manufacture of Concrete Pavement and Machinery for same.

No. 122,498. Patented Jan. 2, 1872.

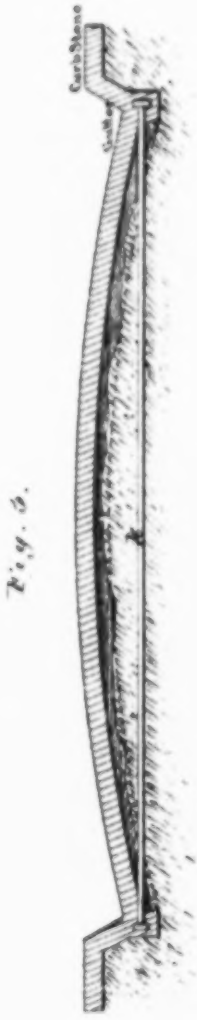


Fig. 5.

Fig. 6.

Witnesses.
C. F. Brown
Richard K. Ellsworth.

Inventor:
W. Harold Smith
By Hill & Ellsworth
Attys.

UNITED STATES PATENT OFFICE.

WILLIAM HARROLD SMITH, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MANUFACTURE OF CONCRETE PAVEMENTS AND IN MACHINERY FOR THE SAME.

Specification forming part of Letters Patent No. 122,498, dated January 2, 1872.

To all whom it may concern:

Be it known that I, WILLIAM HARROLD SMITH, of the city, county, and State of New York, have invented certain new and useful Improvements in the Manufacture of Concrete Pavements and Machinery for the same; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing forming part of this specification, in which—

Figure 1 is a plan. Fig. 2 is a vertical transverse section. Fig. 3 is a side elevation of the machine, showing a part in section. Fig. 4 is a detached sectional view of the mixing-vessel, forcing-vessel, &c. Fig. 5 is a cross-section of the street and pavement; and Fig. 6 is a longitudinal section, showing a modification of the pavement.

Similar letters of reference indicate the same parts.

The object of this invention is to provide for the public an improved street-pavement, an improved method of laying the same, and improved means for carrying said method into practice. To this end the invention consists in the improved machinery and appliances hereinafter described, and in the improved method of constructing pavements and other structures by the use of such machinery and appliance, substantially as hereinafter set forth.

A distinctive feature in my method of laying pavements consists in manufacturing the concrete composition in a fluid or semi-fluid state, so that it will flow through pipes, and in conveying it from the mixing-machine to the spot where it is to be laid, in pipes or conduits and flowing it from the pipes upon the ground, or upon a suitable foundation, where it immediately sets and forms the pavement, its surface being molded to any desired conformation by means of surface molds.

In thus constructing a pavement I preferably use the composition described in an application for Letters Patent of the United States filed by me contemporaneously herewith; but in my improved process or method of laying pavements as herein described, I do not confine myself to that particular composition, but propose to use any composition whatever, now known or hereafter to be discovered, the properties of which adapt it to be conveyed and laid while in a fluid state.

In preparing and laying my improved composition above referred to, I make use of machinery and other appliances, which I will now proceed to describe.

In the first place, for the purpose of thoroughly mixing the materials and conveying them in a fluid state to the spot where they are to be laid, I employ a portable machine, operated preferably by steam-power, said machine being moved along from time to time either by hand or its own motive power as the work progresses. The machine is provided with a rotary mixing-vessel, C, with a crane or other suitable hoisting apparatus, B, which dumps the materials into the mixing-vessel, with a series of grinding and mixing disks, and wheels M N working within the mixing-vessel, with adjustable and movable pipes or conduits D, through which the liquid concrete composition is conveyed from the machine to the street; and also, if preferred, with forcing apparatus, F, which forces the fluid into and through the pipes to its destination, the mixing-vessel being rotated by a friction-wheel, *m'*, upon the shaft *m* of the stirring-wheel, which shaft is driven by a crank and pinion, or other suitable means, operated by the power of the engine. The fixed disks N and rotary stirrers M M are inclined to each other, as shown in Fig. 3, so as to more thoroughly mix the contents of the vessel. The liquid composition, after it has been thoroughly mixed with the pebbles, gravel, or broken stone, flows off from the mixer through passages *d*, provided with suitable valves, into the pipe D, which delivers it wherever it is required for use. When it is necessary to force the liquid up hill, or to convey it quickly or in larger quantities than usual, or through long pipes, or to press it in the mold and expel the air therein, in which it might begin to stiffen before reaching its destination, I employ a forcing apparatus to propel it through the pipes, the same consisting, preferably, of a tight chamber, F, capable of resisting great pressure, into which the liquid flows from the mixer, and a pipe, *f*, by which steam or compressed air can be introduced into the chamber F, upon the liquid, to force the latter, by pressure, into the pipe D. Any other species of forcing apparatus may, however, be substituted, if preferred. A guard or shield, *g*, is attached to the standard which supports the plate N, to

prevent the stirring-wheel from throwing out the liquid when in rapid motion.

Any form of steam-engine, and any construction of propelling apparatus may be used, which will answer the purpose, and the engine may be combined with or set up independent of the machine, and connected to it when in operation by belts, gear-wheels, or other suitable means. The pipe D may be jointed or flexible, to adapt it to be lengthened or shortened, or moved in any desired direction.

By reference to my application for Letters Patent upon the composition which I prefer to employ with this machine, it will be observed that the constituent elements of such composition are cement, sand, water, and gravel, or broken stones. In preparing such composition I place the cement and sand in the mixer, in suitable proportions, and add the water and the broken stones, the apparatus being either in motion or not, as preferred. If not in motion I start it up and run it till the cement and water have become liquid, and the sand and broken stones thoroughly and uniformly mixed therewith. I then open the valves and let it flow off through the pipe D. New materials may be continuously fed to the machine while it is in operation, or the mixing-vessel may be successively filled and emptied, as the manufacturer may prefer.

In laying pavements by means of this improved process and mechanism, where the ground or other foundation is level, it may not be necessary to use surface-molds, as the composition is sufficiently liquid to settle to a perfectly level surface, but where the street is "crowning," or the structure is to be molded to any particular form, surface-molds must, of course, be employed. These molds may be of any suitable structure, and may impress upon the surface of the pavement any desired configuration or design, from the simply-roughened or corrugated surface, shown in Fig. 1, up to the most elaborate patterns that the fancy may suggest.

My method of laying the pavement is preferably as follows, but can, of course, be altered as circumstances may require. First, having removed the old cobble-stones, or other material constituting the old pavement, and leveled the street down to the required grade, I place suitable side molds, *t t*, across the street, and run the liquid between them. It soon sets and forms parallel ribs or walls *w w*. I then place blocks *b b*, preferably of the solidified concrete, at suitable intervals between the walls *w* to assist in supporting the surface-molds, after which the latter are placed, as shown at *e e*, suitable sinking-heads, *s s*, being provided to compensate for the shrinkage of the material in setting. I then connect the pipes D D to the molds and run in the liquid composition, the molds being held down by weights, if necessary. The gutters, curb-stones, and side-walks may all be made at the same time, in one continuous piece with the center of the street, if preferred. In a few minutes after the molds have been filled the liquid will have set sufficiently to allow them to be taken up and advanced to the space between the next two walls, and so on until the whole is laid. Of course removable side molds or bulk-heads may be employed in place of the concrete walls *w w*. The pavement constructed by this process may be of any suitable thickness. Where the ground is soft or there are bad places, liable to settle, it may be made twelve inches or more in thickness, so that when complete it will stand like an arch of solid masonry, entirely independent of any local subsidence of the foundation. When built for this purpose chords or girders *k k* may be embedded in the composition, to operate in lieu of abutments to the arch, or may may be extended across the street under the pavement, as shown in Fig. 5, in which case it may be desirable to protect them from decomposition. So, too, the pavement may be laid upon any kind of foundation, and the foundation may rest flat upon the ground, or be supported above it upon piles, sills, blocks, or other sub-structure, in any manner that may be preferred. They may be protected from decomposition by means of a coating of concrete applied to them, as shown in my former patent, for protecting piles. So, too, the pavement may be cast with supporting ribs on the under side, as shown in Fig. 6.

Suitable provision may be made for the subsequent removal of sections of the stone concrete whenever it may be necessary to get at the water or gas-pipes for the purpose of repairing them, or to get to the ground beneath for any purpose whatever. Spaces may be left unfilled by the concrete and be afterward so filled in that the stones or blocks may be taken out independently of the rest of the pavement. In filling in such spaces a softer material may be used, which can be easily cut out or otherwise removed, or the hard material, if used, may be separated from the surrounding pavement by a thin partition of softer material by strips of wood, or by anything else that will allow the blocks to come out readily, and to give it the required degree of elasticity. If no provision should be made for the purpose blocks can be easily cut out anywhere by means of the newly-invented sand-blast apparatus, or by a saw or other device. To facilitate the cutting out of such blocks strips of wood, or other soft substance, may be embedded in the surface of the pavement, if preferred, to prevent the horses from slipping, though there will be no appreciable danger from such cause, as I design using stones of different degrees of hardness, in order that they may wear unequally, and cause the pavement always to present a rough surface.

A stone-breaking apparatus of any pattern may be used with the mixing machine, and be driven by the same engine, both machines being combined in one, if preferred. With such apparatus, when relaying pavements, I take up the old cobble stones as the work advances, break them up, feed them to the mixing-ma-

chine, and lay them down again in the new pavement a few yards in rear, thereby saving all expense of transportation and effecting an immense reduction in the cost of the materials, beside obviating the necessity of having large tracts of the old pavement up at the same time. In laying the pavement in streets where street-railways are in operation, beds may be cast in the surface of the pavement to receive the rails.

Having thus described my invention, what I claim is—

1. The process of laying concrete pavements by flowing the liquid material upon the bed of the street, substantially as described.

2. The combination of the mixing-vessel with stirring mechanism, and with pipes or conduits to convey the mixed material from the vessel to the street, when adapted to the construction of pavements, substantially as described.

3. The compressing apparatus F, in combination with the mixer, and the pipes or conduits, substantially as and for the purposes described.

4. The portable machine herein described, combining a mixing-vessel, stirring mechanism, and apparatus for operating the same, substantially as described.

5. The surface-molds *e e*, in combination with the conveying pipes or conduits, and the mixing and forcing apparatus herein described, when adapted to the laying of street-pavements with liquid material, substantially as set forth.

W. HARROLD SMITH.

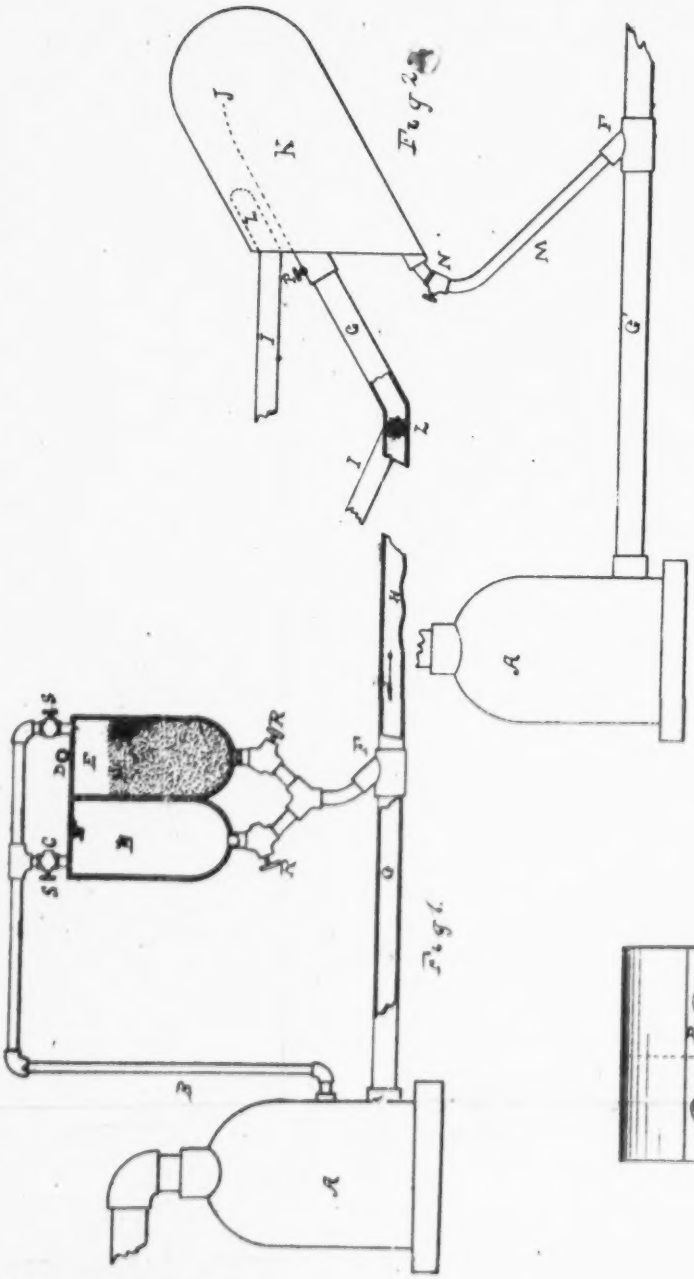
Witnesses:
H. K. ELLSWORTH,
MELLVILLE CHURCH. (110)

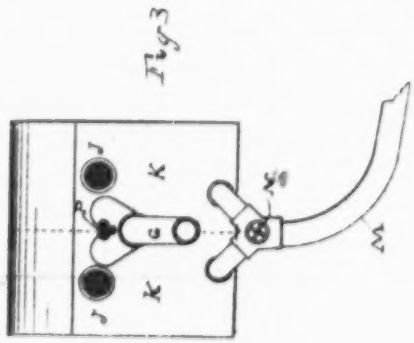
(No Model.)

J. W. BEACH.

PNEUMATIC CONVEYER.

No. 267,318. Patented Nov. 14, 1882.





WITNESSES—
F. P. Adams
Jesse Burr, Jr.

INVENTOR—
James W. Beach.

UNITED STATES PATENT OFFICE.

JAMES W. BEACH, OF CHICAGO, ILLINOIS.

PNEUMATIC CONVEYER.

SPECIFICATION forming part of Letters Patent No. 267,318, dated November 14, 1882.

Application filed April 17, 1882. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. BEACH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Pneumatic Conveyer, of which the following is a specification.

My invention relates to pneumatic transportation; and the objects of my improvement are to provide a continuous current of air passing through a tube, pipe, or box at great velocity, into which current of moving air the article or matter to be transported or conveyed is, in limited quantities, continuously projected or impelled, and also to transmit such article or matter through the tube while in a state of suspension in the air in the tube, and without contact with the sides or bottom of the tube. I attain these objects by the mechanism illustrated in the accompanying drawings.

Figure 1 is a vertical section of a part of the entire machine or apparatus. Fig. 2 is a vertical section of a part of the machine, being the exhaust apparatus, receiver, and discharge and "helper;" Figs. 1 and 2, a vertical section of the entire machine. Fig. 3 is a vertical section of the receivers, switch, and discharge apparatus.

Similar letters refer to similar parts throughout the several views.

A is a reservoir filled with air either by free communication with the surrounding atmosphere at its natural pressure or with air condensed to any degree of elasticity required and kept at a constant equal pressure.

G is a pipe, tube, or box, an open end of which is inserted in the reservoir A, so as to receive the air from the reservoir.

E E are bins or receptacles, into which the articles or commodity to be transported is run or placed through the opening and valve D.

R R are valves or switches, so arranged as to allow communication with one of the bins or receptacles and the pipe G to be cut off while the other bin is being filled.

B is a pipe leading from the reservoir to the bins communicating therewith, and subject to be closed by the valves *s s*.

F is a pipe communicating between the bins E E and the pipe G. The foregoing is included in Fig. 1.

I I, Fig. 2, are exhaust-pipes having their inner ends inclosed or covered (protected) with suitable bars, slats, or screens.

J is a continuation (curved) of the upper half only of the pipe G, projecting into the receiver K.

K K are two receivers, into one of which the commodity in course of transportation is received, from which receiver the air is to be exhausted, or kept as nearly exhausted as is practicable, through the exhaust-pipes by means of suitable exhaust apparatus.

P is a valve or switch by means of which communication between the pipe G and one of the receivers is cut off, and at the same time such communication with the other receiver is opened.

N is a switch or valve by means of which communication between one of the receivers and the pipe M is cut off, and at the same time communication between the other receiver and said pipe is established.

M is a pipe for the common use of the two receivers, and communicating between the pipe G and the two receivers through the switch or valve N.

I I, Fig. 3, are respectively exhaust-pipes, with screens.

P is a switch or valve; K K, receivers; N, a valve or switch.

M is a discharge-pipe leading to helper, by means of which "helper," so-called, a new impetus is given to the article or commodity to be transported.

H, Fig. 1, is the wavy or undulating interior of the pipe G, at a distance from the point F, and made by suitable indentations or elevations, or both, of the surface of the pipe, so as to constitute on the interior of the same a wavy or undulating surface; or may be wholly inside of the pipe, the object being to create an upward current or trend to the air as it rushes through the tube over the undulating or through the undulating interior surface thereof.

The manner of constructing and operating the machine and apparatus may be briefly described as follows:

A strong air-tight reservoir, A, Fig. 1, is constructed at one end of the pipe G. At the other end of the same pipe one or more strong air-

tight receptacles or receivers are constructed. Communicating between the reservoir and receivers is a pipe, G, or tube, air-tight, or nearly so, with the bottom of the interior thereof at a point distant from the point F, Fig. 1, and between said point and the point L, Fig. 2, made wavy or undulating, of not too abrupt character, but of uniform occurrence. These waves may be made either by indentation, elevations, or both, or linings, false bottoms, &c. By means of the pipes I I the air in the pipe G will be exhausted at the points L L, and the current of air from the reservoir, where it is maintained continuously at any desired pressure, or the atmosphere at its natural pressure, will rush through the tube G in the direction of the receiver K, Fig. 2, carrying whatever of limited quantities of grain, flour, or other commodity is continuously introduced into the current at a distance from the point A, the reservoir, or place of ingress of the air.

The manner of introducing or projecting the substance—grain, flour, &c.—to be transported into the current of moving air is to fill one of the air-tight bins E, Fig. 1, through the valve D, then close the valve D, turn on the pressure of the air from the reservoir by means of the valve or stop-cock *s*, open the valve or switch R, Fig. 1. The grain and flour or other article thus introduced into the moving current of air will rush with the current in suspension through the tube G with that velocity with which air under great pressure will seek to fill a vacuum, which vacuum will at all times be maintained, as nearly as is practicable.

To keep the grain, &c., off the bottom of the tube to prevent wear and friction, the waves or undulations H, Fig. 1, are made, and in such form as to be uniform and to create an upward current or tendency to the air, from which upward and onward current or trend the grains of wheat or particles of flour, &c., will constantly be receiving upward as well as onward motion, and cause the same to be transported in suspension. Point L, Fig. 2, will be located near the receiver K. The momentum of the article in transit will carry it past the exhaust-pipe L into the receiver K, which also has an exhaust-pipe through which any air that may escape into the receiver K will be exhausted. When the first receiver K has become nearly filled the pipe G will be connected through the switch P, Fig. 2, with the other receiver, from which in the meantime the air has been exhausted. At the time the switch to the second receiver is being made the switch N, Fig. 2, will be turned so as to cut off communication between the second receiver and the discharge-pipe M, Fig. 2, and at the same time allow the mails, flour, grain, or other substance in transit to be discharged from the first receiver through the pipe M into the pipe G', Fig. 2, through which a current of air is rushing from the reservoir A, Fig. 2, and so the operation of imparting a new impetus or momentum to the article in transit may be repeated as often as may be required.

The pipe G may be laid on the ground or in the earth or suspended above the earth, and may be placed at any angle less than forty-five degrees without material interference with the working of the system. The receiver K will be placed at a point of considerable elevation above the surface of the earth at exposed points, and upon curves where the wave or undulating surface of the interior of the pipe, as shown at point H, Fig. 1, of pipe G, and consequent upward or side, as the case may be, current or trend to the air in the pipe G is not sufficient to prevent violent contact between the pipe G and the article in transit. The pipe should be lined with paper or other elastic substance, or be made of paper or such substance, or be coated on the interior surface with wax or other elastic or pliable substance. Of course the exhaust or vacuum will be located and maintained by any suitable means through the exhaust-tubes I I, Fig. 2, and any artificial pressure required at the remote end of the pipe G can be created and maintained by any suitable apparatus working into or communicating with the reservoirs A A respectively, Figs. 1 and 2.

I am aware that prior to my invention pneumatic conveyers have been used. I therefore do not claim such a combination, broadly.

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a pneumatic machine or apparatus, of a tube or pipe, G, through which a current of air is passed toward the receiver K at great velocity, and into which current, in limited quantities, at a point distant from the point of ingress of the air, is introduced or projected the mail-matter, flour, grain, or other article to be transported.

2. In a pneumatic apparatus, the combination of a pneumatic pipe or tube through which a current of air is passing with great velocity in the direction of the receiver K, the bins or hoppers E E, located at a distance from the point of ingress of the air into the tube G, and communicating therewith, the pipe B, Fig. 1, with stop-cocks *s s* and valves or slides D.

3. The uneven wave-like and undulating interior of the pipe, indented or raised and indented between the point F (and at a distance therefrom) and the point L.

4. The causing of an upward or side or both upward and side trend or current of air in the pipe G by means of the uniform unevenness (at any required point) of the interior of the pipe, causing the air in passing at regular intervals to be compressed, giving the article in transit such new impetus and direction in its flight as may be desired.

5. The exhaust-pipes I I, connecting with said tube G and receiver K, respectively, and having their ends protected by screens or bars so arranged as to draw the air from said pipe G and receiver K, respectively, as nearly in the line

from which the article in transit arrives as is practicable, the exit of the air being from the direction of the receiver, leaving the article in transit by its momentum to enter and settle into the receiver K.

6. The combination of the receivers K K with the discharge-pipe M and switch N, discharging into the pipe G' into a current of air moving with great velocity through said pipe G' from the point of ingress, (for said air,) and the reservoir A, the renewing of the momentum first imparted by means of the helper or pipe G', through which a current of air is impelled at great velocity.

7. In a pneumatic machine or apparatus, the combination of the reservoirs A A, the pipe B, connecting with the bins or hoppers E E, (with valves D,) and valves R R, connecting (at a point distant from the reservoir A) with the pipe G, through which a continuous current of air is propelled with or moving with exceeding great velocity toward the receiver K, and into which rapidly-moving current in said tube G grain, flour, the mails, or other article to be transported is introduced in limited but continuous quantity through the pipe F, and kept from the sides and bottom of said pipe G through the current of air created by suitable indentations or projections or both in the interior of the tube until the said article reaches the receiver K, and, further, the combination aforesaid, together with the receivers K K, with switch N and discharge-pipe M, connecting with the pneumatic pipe G', connecting with the reservoir A and like exhaust-pipes I I and apparatus and like receivers.

8. A pneumatic pipe with the interior surface thereof lined or coated with paper, wax, or other elastic substance.

9. The transmitting or transporting in suspension through the pipe (pneumatic pipe G) of the article to be transported—grain, flour, &c.—by the inertia of moving air passing through the tube with terrific velocity over its uniform undulating—either raised or indented, or both—interior or part thereof, and causing at any given point or points in said pipe a current of air to move in any desired direction or trend by the same means.

10. The introduction into a continuous current of rapidly-moving air or other elastic fluid (at a point distant from the point of ingress thereof) of a continuous and limited quantity of flour, grain, or other article to be transported, all substantially as set forth.

JAMES W. BEACH.

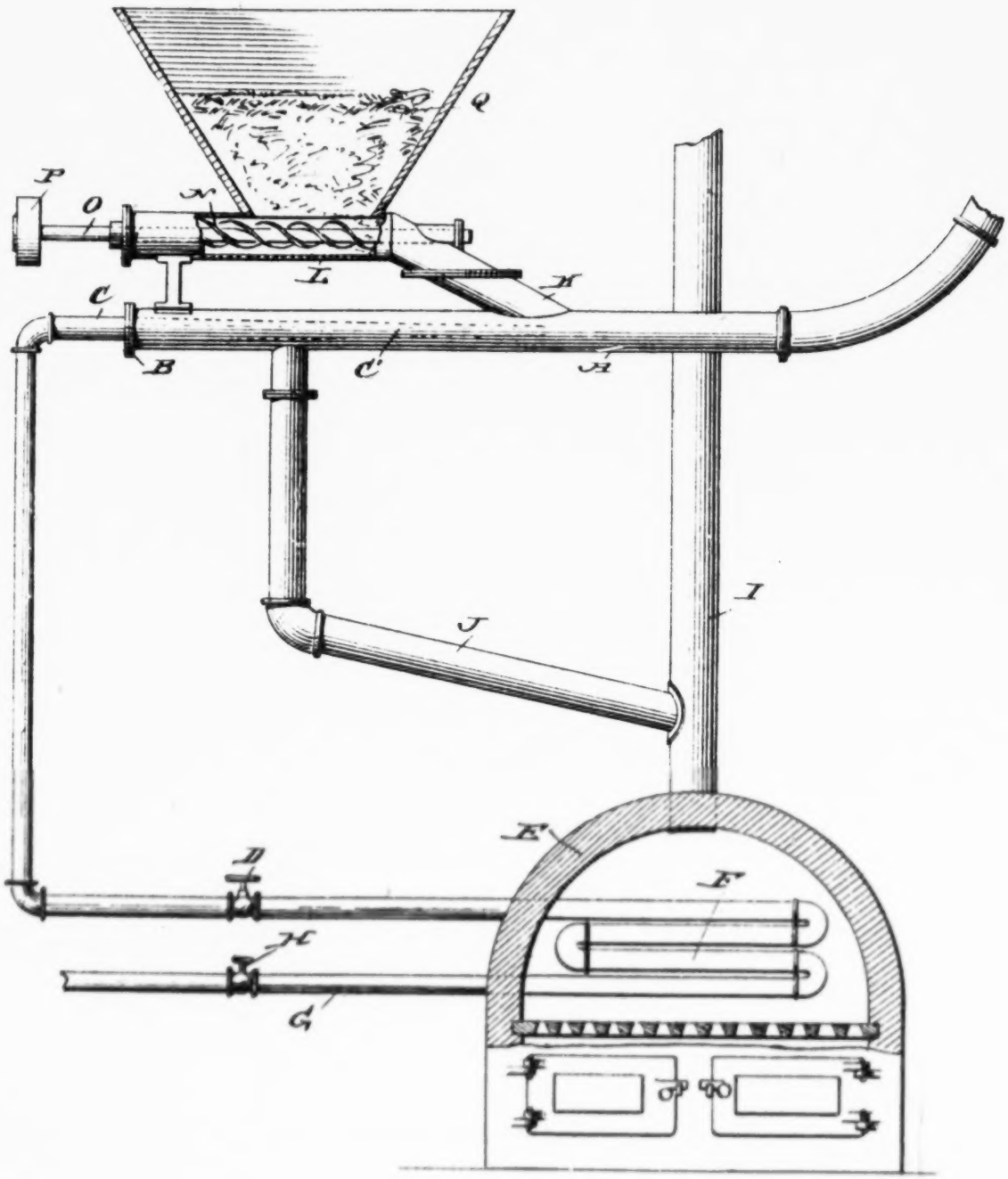
Witnesses:
F. W. ADAMS,
JESSE COX, Jr.

(No Model.)

J. S. WALLACE.

REFUSE EJECTOR.

No. 408,201 Patented July 30, 1889.



WITNESSES:
W. R. Davis
A. Sedgwick

INVENTOR
J. S. Wallace
BY Munn & Co
ATTORNEY

UNITED STATES PATENT OFFICE.

JOHN S. WALLACE, OF NELSONVILLE, OHIO, ASSIGNOR TO HIMSELF, WILLIAM B. BROOKS, JR., AND FRANK A. PRENDERGAST, OF SAME PLACE

REFUSE-EJECTOR.

SPECIFICATION forming part of Letters Patent No. 408,201, dated July 30, 1889.

Application filed March 11, 1889. Serial No. 302,784. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. WALLACE, of Nelsonville, in the county of Athens and State of Ohio, have invented a new and Improved Refuse-Ejector, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved refuse-ejector, which is very simple and durable in construction, effective in operation, and specially designed to remove refuse from ocean steamers, coal-mines, mills, caissons, &c.

The invention consists of a discharge-pipe closed at one end and into which projects and opens a steam-pipe carrying superheated steam, a refuse feed-pipe discharging into the said discharge-pipe at the end of the steam-pipe, and a gas-pipe also opening into the said discharge-pipe between its closed end and the said discharge end of the said refuse-pipe and steam-pipe.

The invention also consists of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawing, in which the figure is a side elevation of the improvement with parts in section.

The discharge-pipe A, of suitable diameter, is closed at one end at B, and is provided at its other end with suitable connections or extensions of any desired length. Into the closed end of the discharge or ejecting pipe A extends a superheated-steam pipe C, having its inner end C′ nozzle-shaped and opening into the said discharge-pipe a suitable distance from the closed end B. The steam-pipe C is provided with a valve D, and extends into a furnace E, of any approved construction, connecting at its inner end with a coil of pipe F, located above the grate-bars of the said furnace and provided with any desired number of bends. The coil of pipe F connects at its other end with a steam-pipe G, extending to the outside of the furnace E and connecting with the boiler supplying the necessary steam. A valve H is formed in the said pipe G outside of the furnace E, and the steam from the boiler passing through the said pipe when the valve H is opened is superheated in the coil of pipe F and passes in a superheated state into and through the pipe C to the discharge-pipe A.

From the furnace E leads the usual chimney I, provided a short distance from the furnace E with a branch pipe J, connecting with the discharge-pipe A at a point between the inner end of the nozzle C′, and the closed end B.

Into the discharge-pipe A opens an inclined pipe K, directly above the front end of the nozzle C′, said inclined pipe K connecting at its upper end with a pipe L, extending horizontally and carrying a feed-screw N, fastened on a suitable shaft O, mounted to turn in suitable bearings in the ends of the said pipe L, and provided on its outer end with a pulley P, connected with a suitable driving mechanism for imparting a rotary motion to the said shaft O.

Into the pipe L and onto the feed-screw N opens a hopper Q, containing the refuse to be ejected. When the feed-screw N is rotated, the refuse from the hopper Q is forced into the inclined pipe K, and from the latter into the discharge-pipe A.

The operation is as follows: When the valve H in the pipe G is opened, steam is admitted from the boiler to the coil F in the furnace E, is superheated in the same to the required degree, and then passes through the pipe C into the discharge-pipe A. The velocity of the steam escaping from the nozzle C′ creates a vacuum in the discharge-pipe A between the nozzle end and the closed end B. In consequence of this vacuum a draft is created in the chimney I, so that the smoke and gases from the furnace E are drawn through the branch pipe J into the discharge-pipe A, and the hot gases combine with the superheated steam at the inner end of the nozzle C′. The power and value of the superheated steam is thus increased by the addition of the smoke and gases from the furnace E. The refuse fed through the inclined pipe K from the hopper Q immediately in front of the nozzle C′ is acted on by the combined force of the superheated steam and gases, so as to force said refuse through the open end of the pipe A to any desired place to which the said pipe A leads.

It will be seen that the velocity with which the refuse is discharged is governed by the velocity of the escaping superheated steam and gases rushing through the pipe A. It is to be understood that the velocity with which the refuse is ejected depends greatly on the

pressure maintained in the boiler and the distance the refuse has to be carried through the pipe A before being deposited.

It is to be further understood that the device can be used for a number of purposes. It is, however, particularly adapted for ejecting refuse to any height and at any desired angle. At coal-mines, where slack and culm have to be disposed of, it is necessary, in order to save room and prevent the obstruction of land, to pile the slack and culm up as high as possible, and as the pipe A can be extended vertically to any desired height the slack or culm can be easily ejected through the said pipe in the manner above described.

Ashes from boilers and furnaces can also be piled up to any desired elevation to save room, or carried long distances, reducing the expense to a minimum. Sawdust from mill-pits, which it requires a great amount of labor and expense to remove, can by the use of this device be taken long distances and to great heights and discharged at a great saving of expense. In large ocean steamers, where the hoisting of ashes and dirt from the hold and engine-rooms is now a slow and laborious proceeding, the work can be made easy, cheap, and efficient, irrespective of stormy or calm weather.

The device is further adapted to the sinking of caissons, for the ejection of the sand and dirt from the interior of the caisson. It is also adapted for ejecting the dirt and mud from dredging-machines to the banks of a canal or stream.

A variety of refuse can be ejected, such as tan-bark, garbage, sand, &c.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a refuse-ejector, the combination, with a discharge-pipe closed at one end, of a steam-pipe carrying superheated steam and opening into the said discharge-pipe, a refuse feed-pipe held at an angle and discharging into the said discharge-pipe at the nozzle end of the said steam-pipe, and a gas-pipe also opening into the said discharge-pipe between its closed end and the said inner end of the said refuse feed-pipe, substantially as shown and described.

2. In a refuse-ejector, the combination, with a discharge-pipe closed at one end, of a steam-pipe carrying superheated steam and opening into the said discharge-pipe, a refuse feed-pipe held at an angle and discharging into the said discharge-pipe at the nozzle end of the said steam-pipe, a gas-pipe also opening into the said discharge-pipe between its closed end and the said inner end of the said refuse feed-pipe, and a furnace discharging into the said gas-pipe and serving to superheat the steam passing through the said steam-pipe, substantially as shown and described.

3. In a refuse-ejector, the combination, with a discharge-pipe closed at one end, of a steam-pipe carrying superheated steam and opening into the said discharge-pipe, a refuse feed-pipe held at an angle and discharging into the said discharge-pipe at the nozzle end of the said steam-pipe, a gas-pipe also opening into the said discharge-pipe between its closed end and the said inner end of the said refuse feed-pipe, and a feed-screw held in the said feed-pipe to discharge the refuse from the said feed-pipe to the nozzle end of the said steam-pipe, substantially as shown and described.

4. In a refuse-ejector, the combination, with a discharge-pipe closed at one end, of a steam-pipe carrying superheated steam and opening into the said discharge-pipe, a refuse feed-pipe held at an angle and discharging into the said discharge-pipe at the nozzle end of the said steam-pipe, a gas-pipe also opening into the said discharge-pipe between its closed end and the said inner end of the said refuse feed-pipe, a feed-screw held in the said feed-pipe to discharge the refuse from the said feed-pipe to the nozzle end of the said steam-pipe, and a hopper containing the refuse and opening on the said feed-screw, substantially as shown and described.

5. In a refuse-ejector, the combination, with a discharge-pipe closed at one end, of a steam-pipe provided with a nozzle extending into the closed end of the said discharge-pipe, a coil of pipe connected with the said steam-pipe and also connected with the boiler, a furnace containing the said coil of pipe and serving to superheat the steam in the said coil of pipe, a feed-pipe discharging into the said discharge-pipe at the end of the nozzle of the said steam-pipe, a chimney extending from the said furnace, and a branch pipe leading from the said chimney into the said discharge-pipe between its closed end and the end of the nozzle, substantially as shown and described.

6. In a refuse-ejector, the combination, with a discharge-pipe closed at one end, of a steam-pipe provided with a nozzle extending into the closed end of the said discharge-pipe, a coil of pipe connected with the said steam-pipe and also connected with the boiler, a furnace containing the said coil of pipe and serving to superheat the steam in the said coil of pipe, a feed-pipe discharging into the said discharge-pipe at the end of the nozzle of the said steam-pipe, a chimney extending from the said furnace, a branch pipe leading from the said chimney into the said discharge-pipe between the closed end and the end of the nozzle, and a feed-screw connected with a hopper and discharging into the said feed-pipe, substantially as shown and described.

JNO. S. WALLACE.

Witnesses:
L. L. BORT,
J. R. ARMSTRONG.

(No Model.) 4 Sheets—Sheet 1.

S. C. DAVIDSON.

PNEUMATIC APPARATUS FOR ELEVATING OR CONVEYING TOBACCO LEAF, TEA LEAF, WOOD CHIPS, &c.

No. 599,055. Patented Feb. 15, 1898.

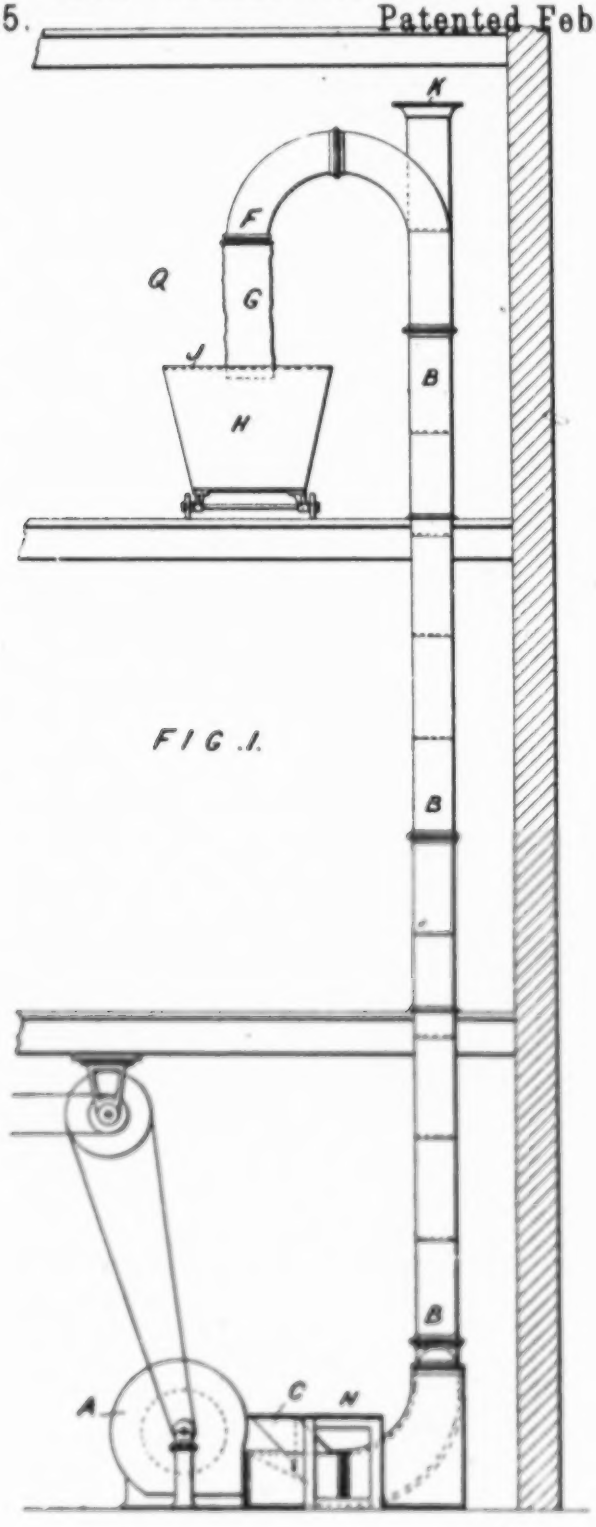


FIG. 1.

WITNESSES:
Fred Whitehead
Thomas P. Wallace

INVENTOR:
Samuel Cleland Davidson,
By his Attorneys
Wilkinson & Fraser & Co

(No Model.) 4 Sheets—Sheet 2.

S. C. DAVIDSON.

PNEUMATIC APPARATUS FOR ELEVATING OR CONVEYING TOBACCO LEAF, TEA LEAF, WOOD CHIPS, &c.

No. 599,055. Patented Feb. 15, 1898.

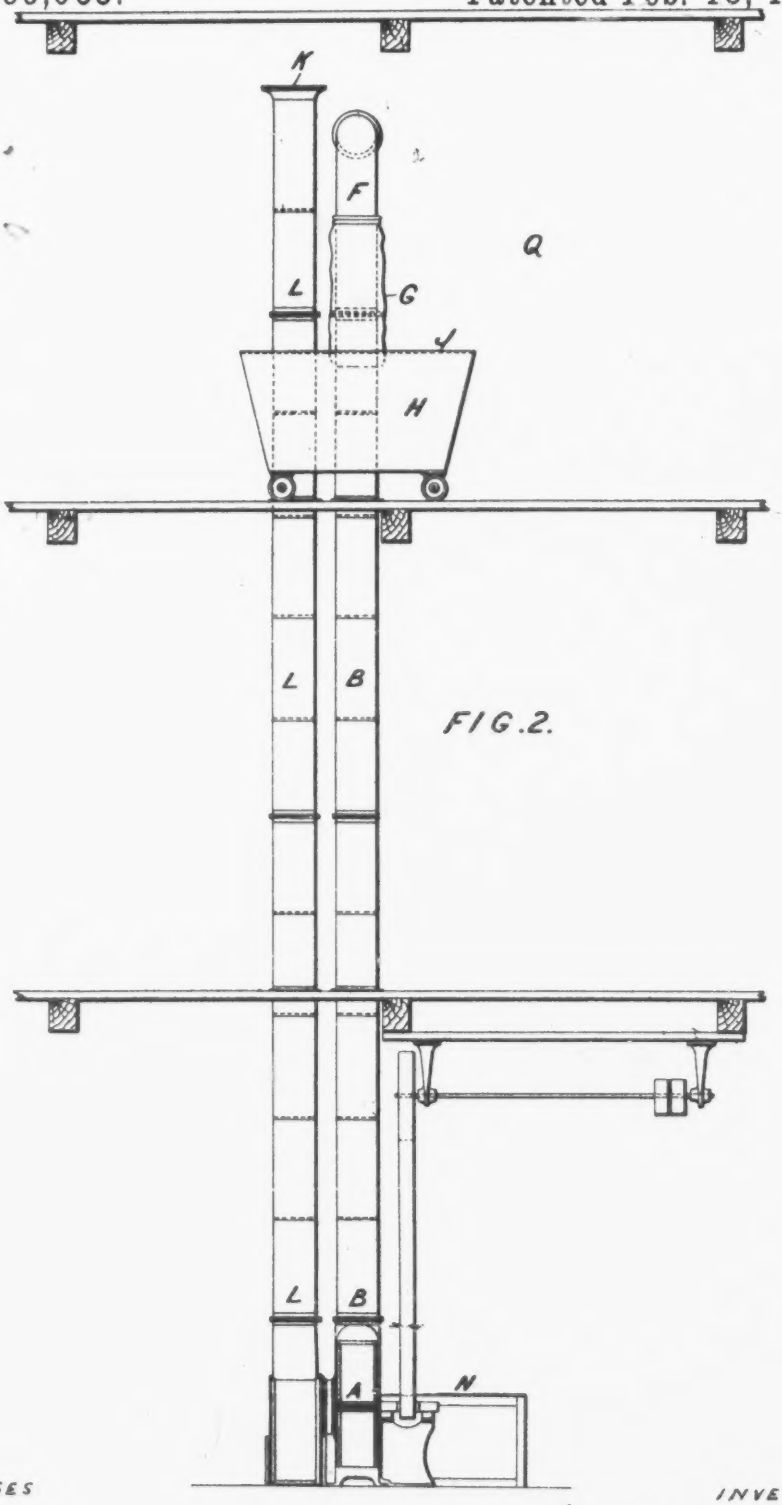


FIG. 2.

WITNESSES
Fred White
Thomas J. Wallace

INVENTOR:
Samuel Cleland Davidson,
By his Attorneys
Arthur C. Fraser & Co

(No Model.) 4 Sheets—Sheet 3.

S. C. DAVIDSON.

PNEUMATIC APPARATUS FOR ELEVATING OR CONVEYING TOBACCO LEAF, TEA LEAF, WOOD CHIPS, &c.

No. 599,055. Patented Feb. 15, 1898.

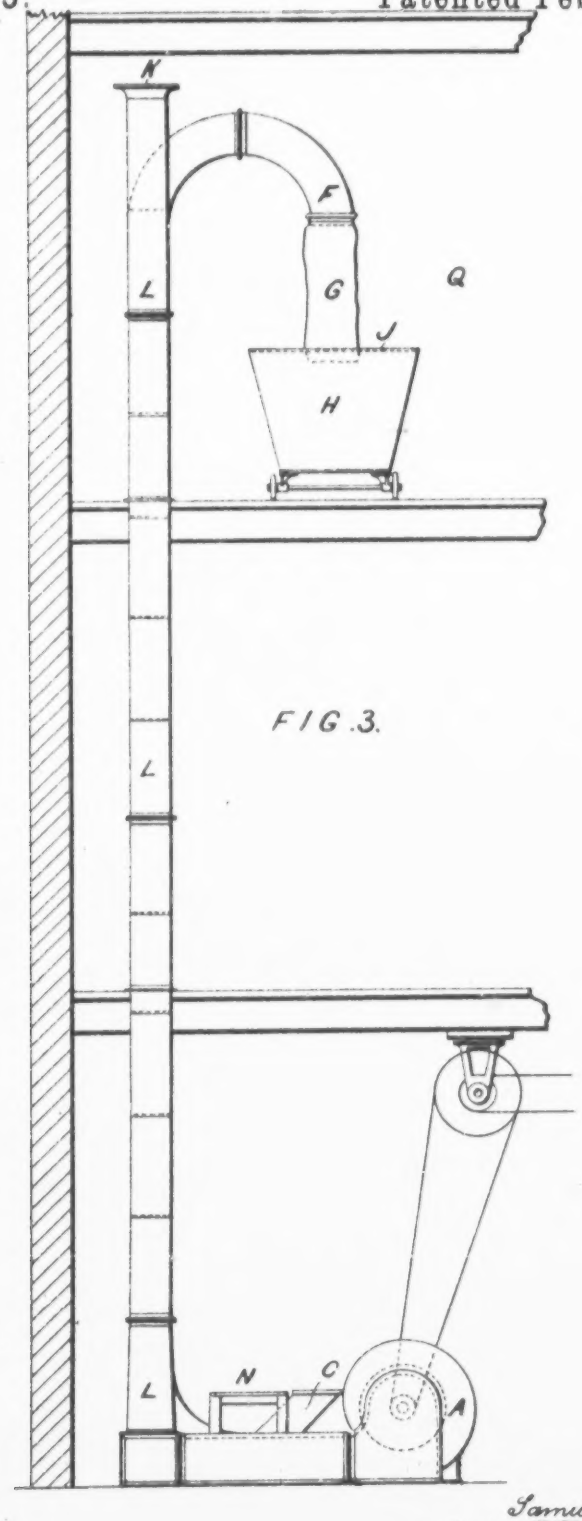


FIG. 3.

WITNESSES.
Fred White
Thomas F. Wallace

INVENTOR
Samuel Cleland Davidson
By his Attorneys
Arthur C. Fraser & Co.

(No Model.) 4 Sheets—Sheet 4.

S. C. DAVIDSON.

PNEUMATIC APPARATUS FOR ELEVATING OR CONVEYING TOBACCO LEAF, TEA LEAF, WOOD CHIPS, &c.

No. 599,055. Patented Feb. 15, 1898.

FIG. 5.

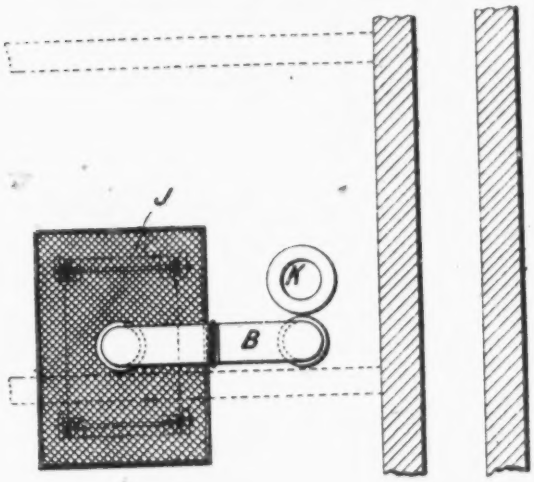


FIG. 4.

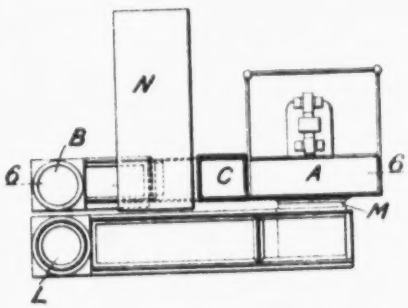
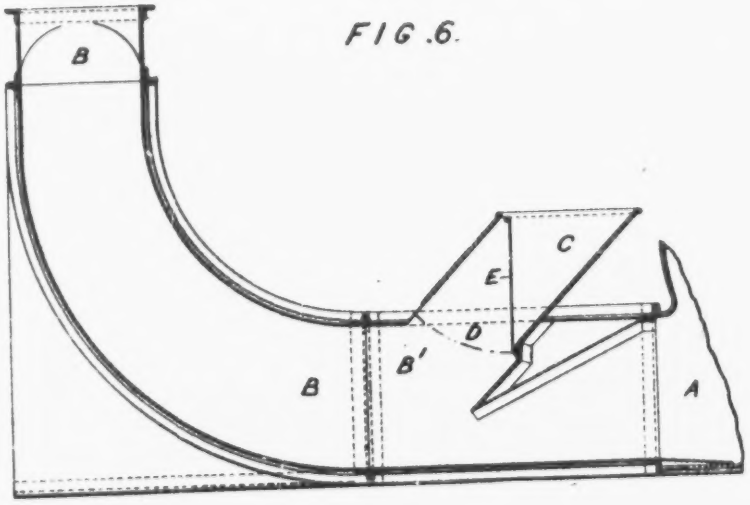


FIG. 6.



WITNESSES

Fred Whitz

Thomas F. Ballard

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys

Wilkinson, Fraser & Co.

UNITED STATES PATENT OFFICE.

SAMUEL CLELAND DAVIDSON, OF BELFAST, IRELAND.

PNEUMATIC APPARATUS FOR ELEVATING OR CONVEYING TOBACCO-LEAF, TEA-LEAF, WOOD-CHIPS, &c.

SPECIFICATION forming part of Letters Patent No. 599,055, dated February 15, 1898.

Application filed July 24, 1897. Serial No. 645,827. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL CLELAND DAVIDSON, merchant, of Sirocco Engineering Works, Belfast, Ireland, have invented certain new and useful Improvements in Pneumatic Apparatus for Elevating or Conveying Tobacco-Leaf, Tea-Leaf, Wood or other Chips or Cuttings, or other Materials, of which the following is a specification.

My invention has reference to pneumatic apparatus for elevating or conveying tobacco-leaf, tea-leaf, wood or other chips or cuttings, or other materials.

The improved apparatus has been more particularly designed for elevating tobacco-leaf.

The chief features of the invention, apart from the general construction or arrangement of the apparatus, are an automatically opening and closing flap door or valve between a feed-hopper and the blast-pipe for the purpose hereinafter set forth, a special arrangement of truck or receptacle at the delivery end of the blast-pipe, and a return-pipe leading from the receiving-room back to the fan or air-propeller, so that the same air is used over and over again in the elevator and in the delivery-room, which is of importance when dealing with some materials—tobacco-leaf, for example.

Having stated the chief features of the invention, I will describe an apparatus in which the improvements are embodied.

In the accompanying drawings, Figure 1 is a side elevation of a pneumatic elevating apparatus constructed according to this invention. Fig. 2 is a front elevation. Fig. 3 is a side elevation taken from the opposite side to that shown in Fig. 1. Fig. 4 is a plan of the lower or receiving portion, showing the fan and the feed-hopper. Fig. 5 is a plan of the upper or delivering portion, illustrating the delivery into a truck. Fig. 6 is a part vertical section on the line 6 6 of Fig. 4, on a larger scale than the other figures, to show the arrangement of the feed-hopper door.

The apparatus consists of a duct or pipe B, through which a strong blast of air is driven from an air-propeller, preferably in the form of a fan A, as shown, a hopper C being attached to the duct B at the fan end and so constructed that when a basketful of tobacco-leaf or other material to be elevated or conveyed through the duct B is thrown into same the leaf drops into an eddy-space B' in the duct formed by enlarging the upper side of the duct, the enlargement gradually converging again to the normal size of the duct, as seen in Fig. 6, in the direction that the blast is moving. There is an inlet port or opening D from the hopper to the said eddy-space B' fitted with a flap door or valve E, which after a basketful or like quantity of leaf or other material has fallen through the hopper doorway or port D and right into the blast-current is at once automatically blown back, so as to close the inlet-port, as seen in Fig. 6, by the temporary back pressure of the air-blast against the back of the flap-door E, due to partial obstruction momentarily caused by the material falling into the air-blast and until same imparts momentum thereto. This automatic closure of the hopper-door E so confines and prevents the escape of any of the air-blast that its full pressure operates on the material thrown into the duct until it has acquired the same velocity as the blast or been discharged at the delivery end of the duct, when the hopper-door freely opens again, and a further supply of material may be thrown in.

N is a table upon which the material to be elevated may be laid, so as to be more conveniently fed into the hopper C.

In the case of some materials—tobacco-leaf, for example—it is in some instances undesirable to deliver into the leaf-receiving room Q such a large volume of fresh air as would be continuously issuing from the delivery end of the conveyer-duct B while working if such air were drawn from another room or from the open air. In order to obviate this, I lead a return-pipe L, having an open mouth or inlet K, from the said delivery-room back to the eye of the fan A, so that the air used in the conveyer-duct B is practically the same air circulating through it over and over again, owing to this air being withdrawn from the same room or compartment Q as the material is being delivered into. Hence the air in the

receiving-room Q is neither added to nor diminished, nor is the degree of atmospheric moisture in the room altered while the apparatus is working, which in some cases is of much practical importance.

In order to collect the leaf or other material in an open-topped box-shaped truck or receptacle at the delivery end of the conveyer-duct B, I keep the delivery end at a sufficient elevation above the ground or floor that when a downwardly-directed bend F is applied thereon there is room for the truck or wagon H to be placed under it, and I apply on the top of the truck a cover J, of wire-netting or other foraminous material, with a central hole in it of approximately the size of the mouth of the conveyer-duct, and I place the truck so that the mouth of the duct, with or without an elongation G, of flexible material, such as canvas, is fair over and the flexible elongation, when used, hanging into the central hole in the wire-netting cover J. This cover, while allowing the free escape of the air reverberating off the bottom and sides of the truck, catches any of the leaf or material which blows upward along with it, and the same falls back again into the truck.

The employment of this device obviates any necessity for what is known as a "stive" or collecting-room.

What I claim, and desire to secure by Letters Patent, is—

In pneumatic apparatus for elevating or conveying tobacco-leaf or other material, the combination of a blast-pipe having an enlargement at the upper side where the material is fed to it, a hopper through which the material is fed into said blast-pipe, and a flap door or valve between the feed-hopper and the blast-pipe and normally more or less open toward the blast-pipe, whereby when a charge of the material is fed through the hopper into the blast-pipe through the door temporary back pressure of the air-blast pipe is produced against the back of the door and the door is therefore automatically closed until the said back pressure ceases, substantially as and for the purpose hereinbefore described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

SAMUEL CLELAND DAVIDSON.

Witnesses:
JOHN BROWN SHAW,
ARCHIBALD H. R. CARR.

318

No. 873,345. PATENTED DEC. 10, 1907

W. L. CANNIFF.

PNEUMATIC GROUT MIXING AND DISCHARGING APPARATUS.

APPLICATION FILED OCT. 29, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

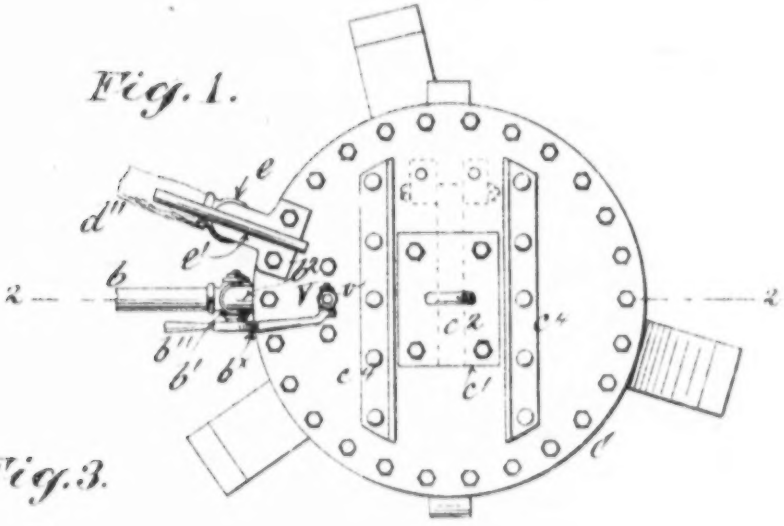


Fig. 3.

Fig. 2.

Fig. 4.

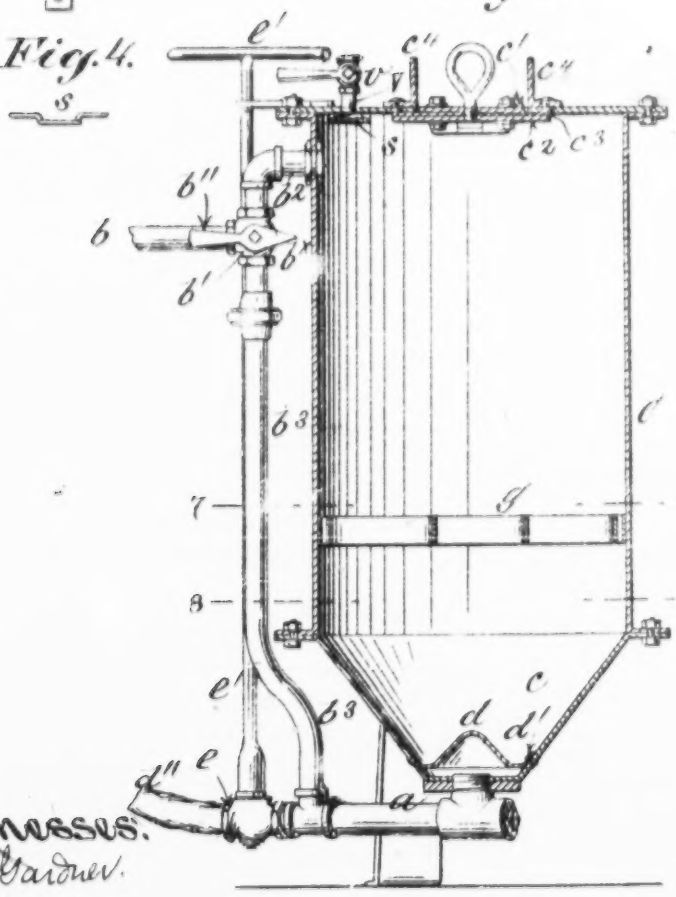


Fig. 5.

Fig. 6.

Witnesses:
D. W. Gardner.
J. Edna

Inventor:
William L. Canniff
By his Attorney
Geo. W. Meath

No. 873,345. PATENTED DEC. 10, 1907.

W. L. CANNIFF.

PNEUMATIC GROUT MIXING AND DISCHARGING APPARATUS.

APPLICATION FILED OCT. 29, 1906.

2 SHEETS—SHEET 2.

Fig. 7.

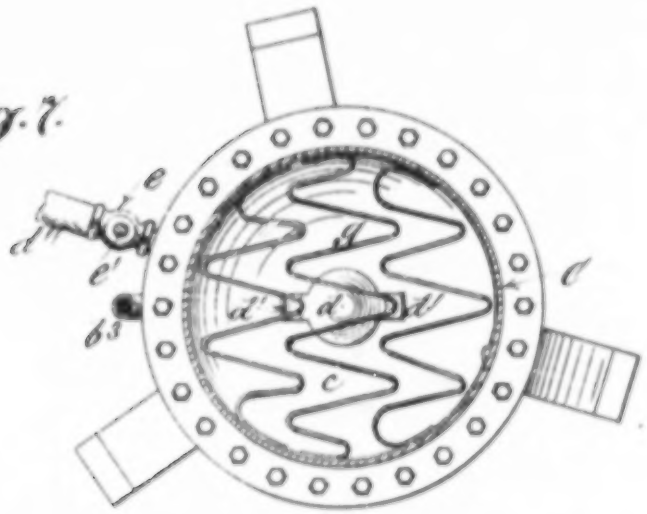
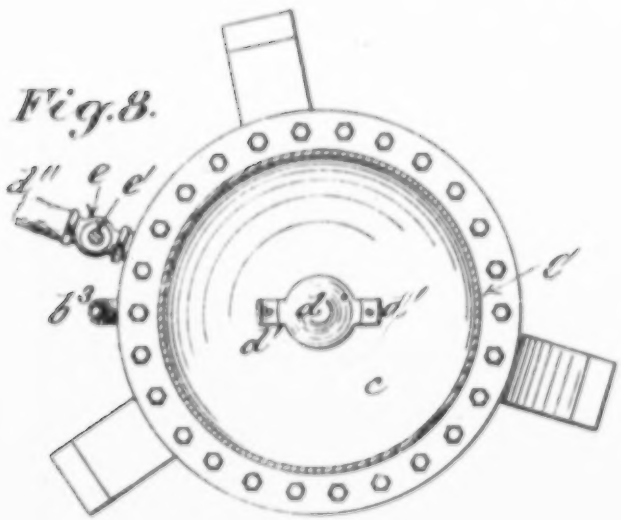


Fig. 8.



Witnesses:
D. W. Gardner
Edna

Inventor:
William L. Canniff
By his Attorney
Leo. Wm. Mudd.

UNITED STATES PATENT OFFICE.

WILLIAM L. CANNIFF, OF NEW YORK, N. Y.

PNEUMATIC GROUT MIXING AND DISCHARGING APPARATUS.

No. 873,345. Specification of Letters Patent. Patented Dec. 10, 1907.

Application filed October 29, 1906. Serial No. 341,042.

To all whom it may concern:

Be it known that I, WILLIAM L. CANNIFF, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Pneumatic Grout Mixing and Discharging Apparatus, of which the following is a specification.

The object of my invention is to effect the admixture of the constituent parts of grout in a more simple, rapid and effective manner than heretofore, at the same time dispensing with mechanical mixers, motors and the like, and rendering the operation essentially automatic in character. Mechanical mixers, with their motors and other essentials are relatively expensive in the first place, necessitate the use of skilled labor, and even with the best of care and attention, need, owing to the gritty character of the material treated, almost constant repair and replacement of parts, so that the expense of running and maintenance is burdensome and detracts materially from their value and utility. I obviate these objections by dispensing entirely with operative parts in the sense that I effect the admixture of the grout without the aid of mechanical beaters, arms or agitators, by means of compressed air. Furthermore, the admixture of elements is more uniform and perfect, and is accomplished in much less time than heretofore.

The invention consists primarily in injecting compressed air into the aggregated material, as sand, cement and water, in such manner that the air in expanding passes through the same, thoroughly agitating and admixing the ingredients by a process which may be designated as "boiling" or analogous thereto. As a result, a uniform blending and distribution of the component parts of the mass is quickly attained, after which compressed air is further utilized to effect the discharge of the admixture as heretofore.

My invention also includes certain specific features in the construction and arrangement of parts hereinafter described and claimed.

In the accompanying drawings, Figure 1, is a plan of a mixing chamber and connections embodying the essential features of my invention; Fig. 2, is a sectional elevation taken upon plane of line 2—2—Fig. 1; Fig. 3, is a plan in detail of the underside of the vent shield; Fig. 4, an edge view of the vent shield; Fig. 5, is a plan of the deflector; Fig. 6, a side elevation thereof; Fig. 7, is a horizontal section on plane of line 7—7—Fig. 2; Fig. 8, is a horizontal section on plane of line 8—8—Fig. 2.

In the practical application of my invention the form or configuration of mixing chamber C is of secondary importance, and I do not limit myself in this respect, neither do I restrict myself to the identical arrangement of parts herein shown, since modifications thereof may be resorted to with like result,—the essential feature in this respect being the use of means whereby compressed air may be forced through the ingredients within the chamber for the purpose set forth.

Obviously a preferable arrangement for practical reasons is to employ a mixing chamber C, the main portion of which is of cylindrical form, and to introduce the compressed air at the bottom of said chamber, so that the air in rising will thoroughly agitate the contents of the chamber. This I prefer to do through the medium of a pipe which is also used as a medium of discharge for the grout after the admixture of the component parts thereof. The lower portion of the chamber C is closed by an inverted conical section *c*, through the truncated end of which the pipe *a*, projects. Over the open end of the pipe *a*, is arranged a deflector *d*, preferably in the form of an inverted dish shaped plate formed with flanged lugs *d'*, by which it is secured to the conical section *c*.

b, is an air pipe extending to any suitable source of supply of air under pressure. This compressed air pipe *b*, enters a three way valve *b'*, communicating through the pipe b^1, with the upper part of the cylinder C and through the pipe b^2, with the combined air inlet and grout discharge pipe *a*. The handle *b''*, of the three way valve *b'*, is formed with a pointer b^3, which indicates the direction of air flow when the valve is open,—the valve being shown as in its closed position in the drawings.

e, is a discharge valve controlled by the handle *e'*.

g, is a transverse grating of any suitable or desired construction inserted in the mixing chamber C to assist in breaking up and disintegrating any lumps of cement or sand inadvertently introduced into the chamber C. As shown in the drawings the grating consists of three zig zag strips of flat metal placed edge-wise with relation to the vertical axis of the cylinder C, with ample space be-

tween their opposed surfaces for the passage of the contents of the chamber in either direction, as will be seen by reference to Fig. 7.

The ingredients of the grout are introduced into the mixing chamber C through the opening c', closed preferably by a swinging door c^2, opening inward and provided with a gasket c^3, for forming an air tight joint when the door is closed,—the door being held by internal pressure in use.

c^4, c^4, are angle beams on the exterior of the cover adjoining the door opening c', and are designed to stiffen and reinforce the edges of said openings so as to insure a close seal with the gasket c^3, on the door c^2.

V is a vent pipe provided with a stop cock v,—the inner end of the vent pipe being protected by a screen s, which admits of the escape of air while intercepting and deflecting any of the grout mixture that might otherwise pass to the vent.

Attached to the discharge valve e, is a flexible pipe d'', through and by which the mixed grout is distributed.

The operation is as follows. The valves b' and e, being closed, the material is introduced through the opening c', the cock v, in the vent tube V opened, the door c^2, closed, and the valve b', turned with the pointer b^x downward, admitting compressed air to the chamber C, and thereby sealing the door c^2, by excess of internal pressure. As the compressed air escapes from the pipe a, it expands and rises, being deflected by the inverted plate d, through the grout material, violently agitating the latter and causing a state of ebullition which results in a thorough and uniform admixture of the ingredients. During this action air escapes around the edges of the shield s and through the vent V. A fraction of a minute (about 30 seconds in fact) is sufficient to insure a thorough blending and distribution of the ingredients to form the grout by this method of "boiling" or agitation, when the valve v, may be closed and the valve b', reversed to shunt the compressed air into the top of the cylinder C, when the valve e, being opened, the grout is discharged by displacement by the pressure and accumulation of compressed air above it in the mixing chamber. In this connection, I wish to state that I am aware that compressed air has been used to force grout from a mechanical mixer, but I am not aware that compressed air has heretofore been employed to agitate and mix the ingredients as a preliminary to such discharge.

It will be seen that my apparatus is extremely simple and inexpensive, there being no operative parts, and nothing to get out of order. Practically the device cleans and lubricates itself in action, and may be used effectually by unskilled labor. Furthermore it is of light and portable structure, a feature of importance in the art to which it appertains as will be readily understood, since it can be transported to the immediate vicinity of the place where the grout is to be applied, and the grout formed and applied direct while fresh and in the best condition. Thus not only save time in the preparation of the grout, but also in handling and manipulation. I have found by practical experience that by my method the materials may be more thoroughly and satisfactorily mixed in one third the time involved in the use of the mechanical mixers, which it is designed to replace, while the cost of my apparatus is comparatively speaking, merely nominal, and the cost for repairs is practically eliminated.

What I claim as my invention and desire to secure by Letters Patent is,

1. In a device of the character designated, the combination of a mixing chamber, means for introducing material to be mixed into said chamber, means for sealing said chamber, and means connected with said chamber for injecting compressed air therein below the material contained therein for the purpose of mixing the same.

2. In a device of the character designated, the combination of a mixing chamber, means for introducing materials to be mixed in said chamber, means for sealing said chamber, means connected with said chamber for injecting compressed air therein below the material contained therein for the purpose of mixing the same, and an air vent and vent valve connected with said chamber, for the purpose described.

3. In a device of the character designated, the combination of a mixing chamber, means for introducing materials to be mixed in said chamber, means for sealing said chamber, means connected with said chamber for injecting compressed air therein below the material contained therein for the purpose of mixing the same, and means for discharging said chamber of its contents by air pressure for the purpose described.

4. In a device of the character designated, the combination of a mixing chamber, means for introducing materials to be mixed in said chamber, means for sealing said chamber, means connected with said chamber for injecting compressed air therein below the materials contained therein for the purpose of mixing the same, an air vent and vent valve connected with said chamber, and means for discharging the mixed material by air pressure for the purpose described.

5. In a device of the character designated, the combination of a mixing chamber, means for introducing materials to be mixed in said chamber, means for sealing said chamber, means connected with said chamber for injecting compressed air therein below the material contained therein for the purpose of mixing the same, an air vent and vent valve

connected with said chamber, and a shield in said chamber opposed to and protecting said vent for the purpose described.

6. In a device of the character designated, the combination of a mixing chamber having an inverted conical bottom, a pipe entering the truncated end of said conical bottom and connected with a discharge pipe and with a compressed air pipe, a compressed air pipe entering the upper portion of said mixing chamber, valves controlling said pipe, means for introducing materials to be mixed in said chamber and means for sealing said chamber, for the purpose described.

7. In a device of the character designated, the combination of a mixing chamber, means for introducing materials to be mixed in said chamber, means for sealing said chamber from within, means connected with said chamber for injecting compresed air through the bottom thereof to mix the materials and means for discharging said chamber of its contents by air pressure, for the purpose described.

8. In a device of the character designated, the combination of a mixing chamber, means for introducing materials to be mixed in said chamber, means for sealing said chamber from within, a pipe entering the bottom of said chamber, means for introducing compressed air through said pipe to mix the materials and means for introducing compressed air into the upper portion of said chamber, for the purpose of discharging the contents thereof.

9. In a device of the character designated, the combination of a mixing chamber, means for introducing materials to be mixed in said chamber, means for sealing said chamber, a pipe entering the bottom of said chamber, a deflecting plate opposed to the opening in said pipe, means for introducing compressed air through said pipe to mix the materials and means for introducing compressed air into the upper portion of said chamber, for the purpose described.

10. In a device of the character designated, the combination of a mixing chamber having an inverted conical bottom, a pipe entering the truncated end of said conical bottom, connecting with a discharge pipe and with a compressed air pipe, an inverted dish shaped deflector plate opposed to the opening in said pipe, a compressed air pipe entering the upper portion of said mixing chamber, valves controlling said pipe, means for introducing materials to be mixed in said chamber and means for sealing said chamber, for the purpose described.

11. In a device of the character designated, the combination of a mixing chamber, a discharge pipe and a pipe for conducting compressed air into said chamber a pipe entering the bottom of said mixing chamber and connecting with said discharge pipe and said compressed air pipe, said compressed air pipe also connecting with the upper portion of the chamber, a three way cock in said compressed air pipe and a valve in the discharge pipe, for the purpose described.

12. In a device of the character designated, the combination of a mixing chamber having an inverted conical bottom a discharge pipe, and a pipe for conducting compressed air into said chamber a pipe entering the truncated end of said conical bottom and connected with said discharge pipe and with said compressed air pipe, said compressed air pipe also entering the upper portion of said chamber, a three way valve in said compressed air pipe, a valve in the discharge pipe, a vent valve communicating with the upper part of the chamber and an inverted dish shaped deflector opposed to the opening in the pipe, which enters the truncated end of the conical bottom, for the purpose described.

13. In a device of the character designated, the combination of a mixing chamber, means for introducing compressed air into the bottom of said mixing chamber, a grating extending transversely across said chamber above the bottom thereof, means for introducing materials to be mixed into said chamber, means for sealing said chamber and means for discharging the contents of said chamber by air pressure, for the purpose described.

14. In a device of the character designated, the combination of a mixing chamber having an inverted conical bottom a discharge pipe, and a pipe for delivering compressed air into said chamber a pipe entering the truncated end of said conical bottom and connected with said discharge pipe and with said compressed air pipe, a compressed air pipe entering the upper portion of said mixing chamber, valves controlling said pipe, a transverse screen in said mixing chamber consisting of a series of flat metal bars arranged with their edges parallel to the longitudinal axis of the chamber, means for introducing materials to be mixed into said chamber and means for sealing said chamber, for the purpose described.

WILLIAM L. CANNIFF.

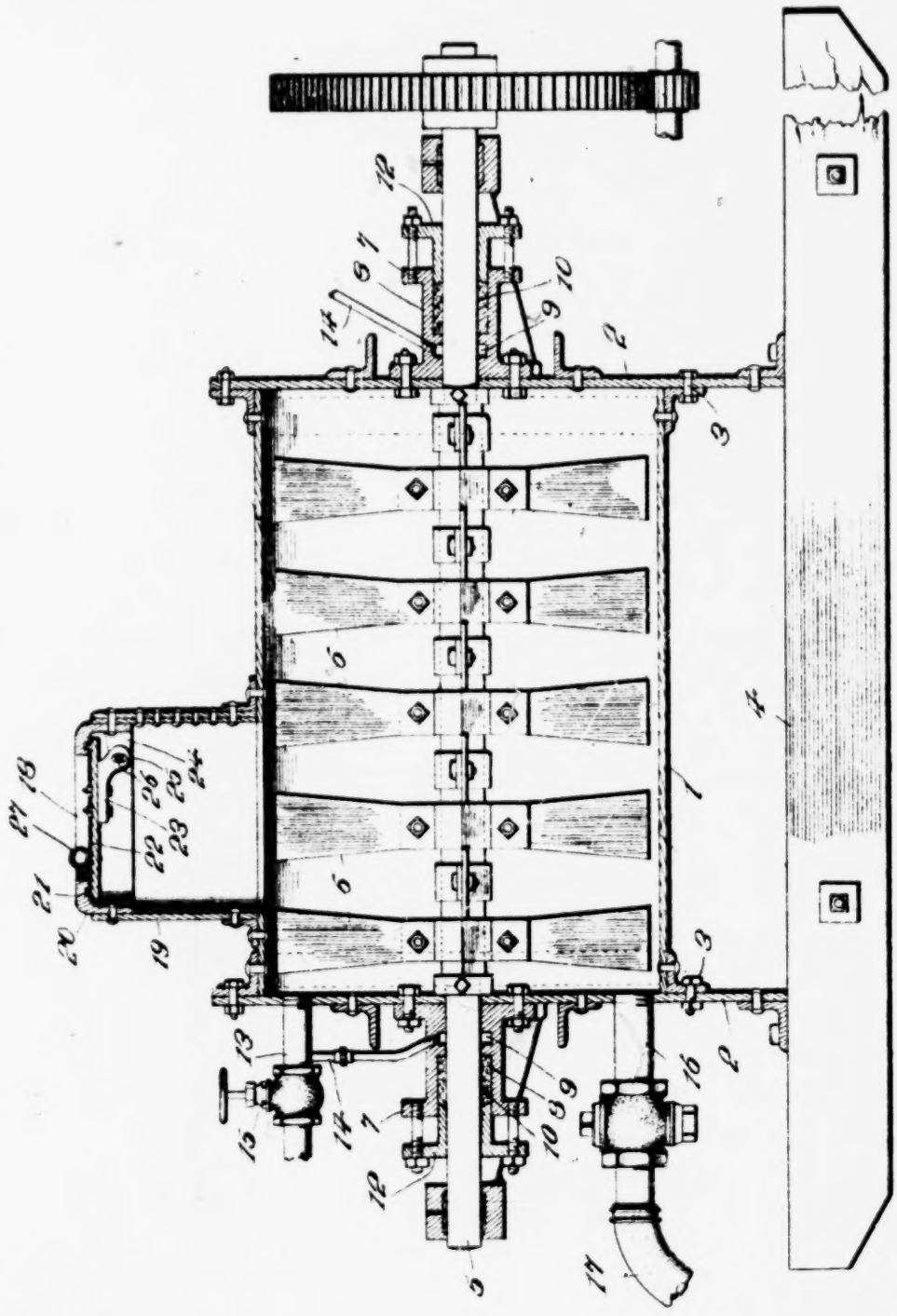
Witnesses:
D. W. GARDNER,
GEO. WM. MIATT.

W. McILVRID.

GROUT MIXER.

APPLICATION FILED NOV. 2, 1905.

958,421. **Patented May 17, 1910.**



Inventor

William McIlvrid,

Witnesses

Louis H. Schmidt.

By

Attorney

UNITED STATES PATENT OFFICE.

WILLIAM McILVRID, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO COCKBURN BARROW & MACHINE COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

GROUT-MIXER.

958,421. Specification of Letters Patent. Patented May 17, 1910.

Application filed November 2, 1905. Serial No. 285,657.

To all whom it may concern:

Be it known that I, WILLIAM McILVRID, of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Grout-Mixers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention contemplates a new and efficient grout mixer, having special reference to means for effecting the thorough intermingling of the ingredients and so ejecting the grout after the mixing is completed that it may be applied directly from the mixer to the work for which it is intended, without an intermediate handling. Broadly stated these purposes are accomplished by the employment of motive fluid under pressure, and the invention further comprehends appropriate features of construction related to the association of the motive fluid with the mechanism.

In the accompanying drawing the figure shows in vertical longitudinal section a grout mixer embodying my invention.

Referring to the drawing 1 designates the cylinder shown horizontally disposed and rigidly supported between vertical end plates 2 and secured thereto as at 3, the plates being mounted upon a skid 4.

5 designates a rotary shaft extending through the cylinder and carrying paddles or blades 6 and having a band or gear wheel at one end. On the outer face of each end plate 2 is a stuffing box 7 for the shaft. These stuffing boxes are shown with their box or sleeve portions 8 bolted to the plates and formed with internal annular recesses or chambers 9 at points intermediate the cylinder and the receptacles 10 for the hemp or other soft packing, the receptacles, as usual in stuffing boxes, being formed by the sleeves and the followers 12, and the latter holding the packing in place.

A pipe 13 is tapped into the cylinder preferably near the top of one end thereof and passages 14 establish communication between this pipe and the annular recesses 9 in the stuffing boxes 7. The pipe 13 is provided with a valve 15.

16 designates an outlet pipe shown leading from the cylinder near the bottom of the head through which pipe 13 is introduced, the outlet pipe having a hose or flexible tubing 17 coupled to its outer end.

The cylinder is provided with a charging opening 18 shown at the top of a dome mounted upon the cylinder and forming a hopper 19. This opening is formed in an angle plate 20 having its vertical portion secured to the sides of the hopper and having an annular groove in the inner face of its horizontal portion in which groove is seated a rubber gasket 21. The opening is controlled by a door 22 having a depending portion 23 hinged to a bracket 24 secured to the side of the hopper 19, the bracket having a vertical slot 25 in which the pintle 26 of the hinge is movable. The door is provided with a handle 27, hopper 19 being of such depth that the door may be swung inward without interfering with the action of the blades.

The operation of the machine described is as follows:—The materials, usually consisting of cement, finely crushed stone, sand and water, are introduced into the cylinder through opening 18, the door 22 being opened downwardly by gravity. The rotation of the shaft is begun to start the agitation and mixture of the materials by the blades. After this has continued a moment, or it may be immediately after introducing the materials, the door 22 is closed and motive fluid, preferably compressed air at about 80 pounds pressure, is admitted to the cylinder through pipe 13; the outlet pipe 16 is opened and the hose 17 held to the work to which the grout is to be applied. The pressure of the air within the cylinder holds the door 22 to its seat, the rubber gasket 21 effectively sealing the opening. The slot 25 in the bracket 24 to which the door is hinged permits the pintle 26 to move vertically or tangentially to the curve described by the door in its swinging movement. This insures the door being evenly seated by the pressure of the air. The air enters through pipe 13 in the form of a strong blast directed toward the opposite end of the cylinder, from which it returns to pipe 16 which is the only outlet. In this travel the blast encounters the materials simultaneously with the stirring of the beaters and their combined actions immediately effect a thorough mingling of the materials by the violence of the agitation. So quickly is this accomplished that the admission of the air mechanically

be delayed once the materials have been introduced and as the outlet is always open while air is being admitted the finished grout is available at once. On account of the nature of the materials their agitation in the manner described occasions wear which the construction of the machine is designed to withstand. The machine illustrated would be impracticable if only the ordinary form of stuffing boxes were employed as the air pressure would force the sand and small particles of stone into the space between the shaft and its bearings and soon wear them out. To avoid this I have provided the annular recesses or chambers 9 in the stuffing boxes. When the air is admitted through pipe 13 it passes through passages 14 to these recesses and forms practically an air stuffing or packing, equalizing any portion of the air which might tend to pass out of the cylinder around the shaft, and preventing the small particles entering the bearing and preserving the soft packing from injury.

The advantages of my invention are apparent. The readiness with which the finished grout is made and applied without requiring, as a separate step, its removal from the cylinder by hand or otherwise, and the effective mechanism employed have rendered the machine available for use in the building of sea walls, foundations, etc., since the grout is expelled with such force that it may be thrown in a stream to some distance from the operator.

I claim as my invention:—

1. In a mixing machine, a receptacle for the materials, a rotary shaft extending therethrough, blades on said shaft, a pipe conducting motive fluid under pressure to said receptacle, a packing box having a chamber surrounding said shaft without said receptacle, and a passage establishing communication between said pipe and said chamber.

2. In a mixing machine, a receptacle for the materials, a rotary shaft extending therethrough, blades on said shaft, a pipe conducting motive fluid under pressure to said receptacle, a sleeve surrounding said shaft without said receptacle, an internal annular recess being formed in said sleeve, and means for establishing communication between said pipe and said recess.

3. In a mixing machine, a receptacle for the materials, a rotary shaft extending therethrough, blades on said shaft, a stuffing box on said shaft without said receptacle and containing soft packing, an internal annular recess being formed in said box intermediate said soft packing and said receptacle, a pipe designed to conduct motive fluid under pressure to said receptacle, and a passage establishing communication between said pipe and said recess.

4. In a grout mixer, the combination with the casing having a rotary shaft extending therethrough, blades on said shaft, means for rotating said shaft, a dome on said casing having a charging opening, and an inwardly swinging door mounted in said dome and controlling said opening, of a pipe entering said casing and adapted to convey a charge of compressed air into said casing to co-act with said blades in effecting the mixing of materials and to hold said door to its seat, and an outlet pipe adapted to convey the mixed material from said casing under the pressure of the air blast.

5. In a grout mixer, the combination with the casing having a rotary shaft extending therethrough, blades on said shaft, means for rotating said shaft, a dome on said casing having a charging opening, an inwardly swinging door mounted in said dome for controlling said opening, and means permitting said door to move tangentially to the curve described in its swinging movement, of a pipe entering said casing and adapted to convey a charge of compressed air into said casing to co-act with said blades in effecting the mixing of materials and to lift said door and hold it elevated against its seat, and an outlet pipe adapted to convey the mixed materials from said casing under the pressure of the air blast.

6. In a mixing machine, a receptacle for the materials, a hopper having a charging opening, an inwardly-swinging door located wholly within the hopper and designed to be normally held seated over said charging opening by internal pressure, rotary blades within said receptacle, means for supplying a fluid under pressure to said receptacle, and means for conveying the mixture away from the latter.

7. In a grout mixer, the combination with the casing having a charging opening and an outlet, a rotary shaft extending therethrough, said casing having a packing sleeve secured to the outer face of one of its ends through which sleeve said shaft extends, said sleeve having a recess surrounding said shaft, blades on said shaft within said casing, and means for rotating said shaft, of a pipe entering said casing and adapted to convey a charge of compressed air into said casing, and a tubular connection between said pipe and said recess, for the purpose stated.

8. In a grout mixer, the combination with the casing having a charging opening and an outlet, a rotary shaft extending therethrough, said casing having a packing sleeve secured to the outer face of one of its ends through which sleeve said shaft extends, said sleeve having a packing receptacle, soft packing therein, and a gland for compressing said packing, said sleeve also having a recess surrounding said shaft, blades on said shaft within said casing, and means for

rotating said shaft, of a pipe entering said casing and adapted to convey a charge of compressed air into said casing, and a tubular connection between said pipe and said recess, for the purpose stated.

9. In a grout mixer, the combination with the mixer casing having a charging opening, of means for mixing materials in said casing, means for conducting air under pressure into said casing, means for sealing said charging opening held seated by said air pressure within the casing, and means for ejecting the mixed materials from said casing by the pressure of the air.

10. In a grout mixer, the combination with the mixer casing having a charging opening, of an inwardly swinging door controlling said opening, means for mixing materials in said casing, a pipe entering said casing and adapted to convey a charge of compressed air into said casing to hold said door to its seat, and an outlet pipe leading from said casing through which the mixed materials are ejected by the pressure of the air.

11. In a grout mixer, the combination with the mixer casing having a charging opening, of an inwardly swinging door controlling said opening, means permitting said door to move tangentially to the curve described in its swinging movement, means for mixing materials in said casing, a pipe entering said casing and adapted to convey a charge of compressed air into said casing to force said door against its seat, and an outlet pipe leading from said casing through which the mixed materials are ejected by the pressure of the air.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

WILLIAM McILVRID.

Witnesses:
GRAFTON L. McGILL,
ALICE LIND.

[fol. 417] IN UNITED STATES DISTRICT COURT

OPINION—NOV. 8, 1926

AUGUSTUS N. HAND, District Judge:

This is an attempt to retry the issues determined in the case of Concrete Mixing & Conveying Co. v. Ulen Contracting Corporation, 12 Fed. (2d) 929; 931. The main reliance is upon a prior use which is alleged to have occurred over twenty years ago. No contemporary sketches are produced and the two witnesses attempt to describe from memory a mechanism which was not used except on two occasions. If such a practical device as that of the patent in suit had been employed, it is hardly likely that a contractor used to conducting large enterprises would not have sought a patent, or at least have taken advantage of something which in recent years has met with signal success. I am not satisfied that the defendants have established the prior use.

Aside from this new proof the defendants rely on the old contention made in the earlier case that their device is purely kinetic. I do not regard it as theoretically probable that masses of concrete containing gravel stones of a diameter running to one and a half inches can be blown long distances by compressed air and I think the testimony of Mr. Ray that he could detect the passage of a series of [fol. 418] slugs when he put his ear to the outlet pipe is the more probable testimony. Moreover, if air were floating the concrete it would be bound to pass through the pipe and the pressure would be so rapidly reduced that the heavier portions would be left in the pipe.

All of the claims were infringed until the Powers-Kennedy structure was impaired in the hope of avoiding infringement. After ceasing to introduce pressure behind the mass of concrete by means of closing the upper valve, it is true that some of the claims are not met, yet some of them are. There is undoubtedly a pressure behind the mass in defendants' machine far greater than ordinary air pressure and varying according to the freedom with which the air in the outlet tube is passing through it. As each slug was discharged, the pressure in the discharge pipe would lessen and the pressure behind the mass amounting

to something like thirty pounds would force a further slug into the outlet. If this were not so, the high pressure through the discharge pipe would hold back the concrete.

As for the point raised that patents for kinetic devices are pertinent prior art, it is answered by the fact that neither the patent in suit nor the defendants' device are kinetic in operation.

The complainant is entitled to an interlocutory decree with the usual reference, the same to be settled on notice.

A. N. H., D. J.

[fol. 419] In United States District Court

Interlocutory Decree—Nov. 11, 1926

This cause came on to be heard at this term at final hearing on pleadings and proofs, and was argued by counsel for both parties; and now after due consideration thereof, it is ordered, adjudged and decreed as follows:

1. That the plaintiff is the sole an exclusipe owner of United States Letters Patent No. 1,127,660 for Method of and Apparatus for Transporting and Treating Concrete granted February 9th, 1915, to John H. McMichael, assignor to the plaintiff, the same being the letters patent in suit, and also of all claims and demands in law and in equity for any and every infringement thereof.

2. That the said Letters Patent No. 1,127,660 are good and valid in law, and particularly as to claims 2, 4, 6, 17, 21, 22, 28, 34 and 35, (plaintiff having voluntarily waived a decree under the other claims recited in the stipulation between the parties in which the claims relied on are specified), and that the said John H. McMichael was the original, first and sole inventor and discoverer of the improvements described and claimed in the said Letters Patent and set forth in the specification thereunto annexed.

3. That the defendants, Powers-Kennedy Contracting Corporation and Anthony G. Fleck have infringed the said [fol. 420] Letters Patent and particularly claims 2, 4, 6, 17, 21, 22, 28, 34 and 35 thereof, and the exclusive rights of the

plaintiff thereunder by making and causing to be made, and using apparatus and employing a method for elevating and transporting concrete embodying and practicing the invention of said Letters Patent and the improvements patented as aforesaid, as charged in the Bill of Complaint herein.

4. That a perpetual injunction issue in this suit against the said defendants, restraining them, and each of them, their officers, agents, servants and employees, and all persons acting under or for them, from directly or indirectly making, selling, using, or otherwise disposing of apparatus for elevating and transporting concrete or utilizing or practicing any method for elevating and transporting concrete embodying or realizing the invention or improvements of said Letters Patent No. 1,127,660.

5. That the plaintiff do recover of the defendants the profits, gains, and advantages which the said defendants, and each of them, have realized, or which have arisen or accrued to them on account of or in connection with the said infringement, and the damages resulting from the said infringement, together with the costs of this suit to be taxed.

6. That it be referred to William Parkin, of the City, County and State of New York, as Master pro hac vice, to ascertain, take and state and report to the court an account of the extent and circumstances of the manufacture, sale [fol. 421] and use and employment of the said method and apparatus, embodying said invention and improvements as described in and secured by said Letters Patent No. 1,127,660, the number of such apparatus made, sold, used and employed and the quantity of concrete placed by the defendants and each of them with such apparatus, and by the use or employment of it and the said method, and also the gains, profits and advantages which the said defendants and each of them has received or which have arisen or accrued to them, from the said infringement, and the damages which the plaintiff has suffered by reason of said infringement, the matter of the increase of damages as prayed in the bill of complaint, to be left until the coming in of the said Master's report.

7. That the plaintiff on such accounting have the right to cause the examination of the defendant Fleck, and the officers, agents and employees of the corporate defendant ore tenus or otherwise, and also to the production of their books, records, accounts, vouchers and documents, and that they attend for such purpose, before said Master, from time to time, as said Master shall direct, and file with the said Master an account of the said profits, gains and advantages in detail, giving the items, dates and details and the extent of the manufacture, sale, use and employment of the said apparatus and method and the quantity and amount of concrete placed, the number of apparatus used, and the manner in which the same were used, and such other informa-
[fol. 422] tion relating thereto as said Master shall direct.

Augustus N. Hand, U. S. D. J.

In United States Disrtict Court

Stipulation re Decree, etc.—March 17, 1927

1. It is hereby stipulated and agreed by and between the parties hereto through their respective counsel, that the plaintiff's damages and the defendants' profits, and the amount to be recovered by the plaintiff, which plaintiff is entitled to recover from the defendants herein, is, and is hereby fixed at the sum of Twenty-one thousand ($21,000) dollars exclusive of costs; that the accounting proceedings herein before Wm. Parkin, Esq., Special Master, shall be terminated forthwith, and the said sum fixed as the amount which would have been awarded to the plaintiff on the said accounting by the said Master; and that no further or other accounting shall be had herein, but that this stipulation and agreement shall be in lieu of any such accounting and any report or award and confirmation of the same by the court.

2. It is further stipulated and agreed that the plaintiff may enter a final decree herein in the usual form, a copy
[fol. 423] of which is hereto annexed, awarding it the said sum of Twenty-one thousand ($21,000) dollars as damages and profits to be recovered from the defendants, with costs

to be taxed, and have judgment and execution therefor, with the same force and effect as if the said sum had been awarded by the Master and his award confirmed by the court, said decree to be entered forthwith; but that the defendants shall have thirty days from the entry of such decree within which to take an appeal therefrom to the United States Circuit Court of Appeals for the Second Circuit, and give the supersedes bond herein provided for, but said appeal shall not question the amount of damages and profits.

3. It is further stipulated and agreed that the defendants shall within thirty days from the entry of the said decree take an appeal therefrom to the U. S. Circuit Court of Appeals for the Second Circuit, and shall as a condition prerequisite to the allowance of such appeal furnish, serve and secure the approval of a bond with sufficient surety in and for the said amount and sum of Twenty-one thousand ($21,000) dollars, to secure the payment of that amount and costs if the decision of the District Court herein is affirmed by said Court of Appeals in whole or in part, so that one or more of thec laims of the patent in suit is found to be valid and infringed, said bond to act as a supersedeas bond until the Mandate of the said Court of Appeals is issued; and said amount, and any judgment that may be [fol. 424] entered therefor in this suit to be paid, with interest from the date hereof, forthwith, and the said bond to guarantee such payment. The right to appeal after said thirty days is hereby waived.

4. It is hereby stipulated and agreed by and between the parties hereto, through their respective counsel, that immediately upon the approval and filing of the aforesaid supersedeas bond for Twenty-one thousand ($21,000) dollars, interest and costs, plaintiff will without delay cooperate with defendant in securing an Order from the Court, and otherwise properly moving, to release the attachment or other lien which plaintiff has caused to be filed with the Controller of the City of ew York, against the moneys now due and payable to defendant upon its contract with the City of New York for the construction of the Forty-second Street Subway, the purpose being to re-

lease said moneys due defendant as soon as plaintiff is protected by the filing of the supersedeas bond.

Dated March 17th, 1927.

Stephen J. Cox, Plaintiff's Solicitor. John D. Morgan, Alan M. Johnson, Defendants' Solicitor.

[fol. 425] IN UNITED STATES DISTRICT COURT

FINAL DECREE—March 19, 1927

An interlocutory decree having been entered herein November 12th, 1926, adjudging Letters Patent in suit No. 1,127,660 valid and infringed as to claims 2, 4, 6, 17, 21, 22, 28, 34 and 35 thereof, directing the issuance of a perpetual injunction against the defendants for said infringement, awarding damages and profits to the plaintiff against the defendants for said infringement and cost, and directing an account of said profits and damages, and the parties hereto having waived further accounting proceedings and agreed upon the sum of Twenty-one thousand ($21,000) dollars as the amount of said costs and profits to be recovered by the plaintiff against the defendants and that a final decree for the same may be entered forthwith, as set forth in the annexed stipulation, filed and approved herewith, it is

Ordered, adjudged and decreed that the said defendants pay to the said plaintiff and the said plaintiff recover of the said defendants the said sum of Twenty-one thousand ($21,000.) dollars, the amount of plaintiff's damages and defendants' profits, together with the costs of this suit to be taxed, and that the plaintiff have judgment and execution therefor against the defendants.

Dated March 19, 1927.

John C. Knox, U. S. D. J.

[fol. 426] Approved as to form.

Stephen J. Cox, Plaintiff's Solicitor. (Sig.) John D. Morgan, Alan M. Johnson, Defendants' Solicitors.

In United States District Court

Petition for Appeal and Order Allowing Same—April 5, 1927

The above named defendants, conceiving-themselves aggrieved by the final decree made and entered on the 21st day of March, 1927, do hereby appeal from said final decree to the United States Circuit Court of Appeals for the Second Circuit, for the reasons specified in the assignment of errors filed herewith, and they pray that this appeal may be allowed, and that a transcript of the record, proceedings and papers upon which said decree was based may be sent to the United States Circuit Court of Appeals for the Second Circuit.

John D. Morgan, Solicitor for Defendants. Alan M. Johnson, Counsel for Defendants.

[fol. 427] Allowance of Appeal

The foregoing appeal is allowed.
April 5, 1927.

F. A. Winslow, U. S. District Judge.

In United States District Court

Assignment of Errors—April 5, 1927

It is respectfully submitted that:

1. The trial Court erred in holding that:

"This is an attempt to retry the issues determined in the case of Concrete Mixing and Conveying Co. vs. Ulen Contracting Corporation, 12 Fed. (2) 929; 931."

for the—

(a) Alleged infringing structure is radically different;

(b) The mode of operation covering upper and lower air ports to admit air under pressure above the mass of concrete in the blower, to blow slugs or cylinders of dry concrete into the path of the lower air jet, which jet broke

them off and carried them, as slugs or cylinders along the pipe, like spit balls in a boy's bean shooter, was entirely [fol. 428] different from defendants' structure, where only the lower air jet was employed, the extremely wet concrete dropping by gravity and being carried along in suspension by the air in the pipe; this method being known in this case as the kinetic method, like the prior art.

(c) The prior patented art is different (The Smith patent 122,498 for blowing concrete by air under pressure was not before the Court in the Ulen suit, nor was the Smith patent 122,497 for liquid concrete that would flow through a pipe, as well as other prior patents cited in this suit).

(d) The prior use testimony in this suit was not in the Ulen suit.

2. That the Trial Court erred in holding, in effect that the patent in suit for blowing concrete was a pioneer patent, and therefore entitled to a broad range of equivalents, when the evidence in this suit (not submitted in the prior Ulen suit) shows that it was old in the prior Smith patent 122,498 to blow liquid concrete uphill through pipes:

"The liquid composition, after it has been thoroughly mixed with the pebbles, gravel or broken stone flows off from the mixer * * *. When it is necessary to force the liquid (concrete) uphill or to carry it quickly or in larger quantities than usual, or through long pipes, * * * [fol. 429] I employ a forcing apparatus to propel it through the pipes, the same consisting preferably of a tight chamber F, capable of resisting great pressure, into which the liquid (concrete) flows from the mixer, and a pipe f, by which steam or compressed air can be introduced into the chamber F, upon the liquid to force the latter, by pressure into the pipe D."

3. That the Trial Court erred in not holding the patent in suit invalid in view of this Smith patent 122,498.

4. That the Trial Court erred in not holding that in view of this Smith patent 122,498, as well as the Smith patent 122,497 for very wet liquid concrete that would flow through a pipe (such as defendants use) that the patent in suit must be limited, as it was in the Ulen suit, to propelling slugs or

cylinders of comparatively dry concrete in the discharge pipe, in the same manner as "spit balls" are propelled in a boys pea shooter.

5. That the Trial Court erred, therefore, in not holding that defendants' blower, working on a different principle and with wet liquid concrete, did not infringe the patent in suit.

6. That the Trial Court erred in totally ignoring, and giving no force or effect to these two Smith patents 122,498 and 122,497.

[fol. 430] 7. That the Trial Court erred in holding:

"The main reliance is upon a prior use which is alleged to have occurred twenty years ago."

(The prior use was one of the defenses but not the main defense. It, however, alone is sufficient to invalidate the patent in suit.)

8. That the Trial Court erred in holding that:

"I do not regard it as theoretically probable that masses of concrete containing gravel stones of a diameter running to one and a half inches can be blown long distances by compressed air * * *."

In making this holding the Trial Court ignored—

(a) The matter of common knowledge that air in a tornado or cyclone, where it is not confined as for example in a pipe, will carry large branches of trees, large boards, bricks from chimneys, stones, roofs, etc., and, in fact, all kinds of objects hundreds of yards, and even the smaller objects a mile or more.

(b) The article by Mr. Kirkland, the Chief Engineer of the plaintiff who had had over five (5) years experience with plaintiff's machines prior to writing the article:

"As the portions of the batch drop into the lower air stream, which has a velocity of about 5,000 feet per minute, these portions are carried along in suspension much as dust [fol. 431] is carried along in a storm except that the particles are much closer together."

(Article by Mr. Kirkland, their Chief Engineer in Journal of Western Society of Engineers, May, 1918, Defendants' Exhibit H.)

(c) This documentary evidence, by their own chief engineer, given several years before any suit was brought on the patent in suit, or contemplated, that the concrete of the patent in suit was conveyed in suspension in the air.

(d) The same article by their Chief Engineer, Mr. Kirkland on pages 334 and 335 of the Journal of Western Society of Engineers of May, 1918, that limestone screenings and sand were blown in "much as dust is carried along in a storm,"—

"Where packing was used it was placed with the pneumatic machine. The packing consisted of a (dry) mixture of 75 per cent limestone screenings and 25 per cent sand. This was blown in filling the cavity completely and packing it tightly so that the weight or any pressure from rock settlement was evenly distributed over the barrel of the arch through the packing."

(This is the flotation or kinetic method, used by defendant and common in the prior art.)

[fol. 432] (e) The testimony of eminent engineers called as witnesses by the defendant as well as the testimony of Mr. Dyer, the patent expert, that the method employed by defendant was, in fact, the flotation or kinetic method.

9. The Trial Court erred in holding that:

"All the claims were infringed until the Powers-Kennedy structure was impaired in the hope of avoiding infringement."

(There is no testimony upon which to base such a holding.)

10. The Trial Court erred in not holding, as testified to by the witnesses, that no top air was used for several years prior to the beginning of this suit, and that it worked better, with the liquid concrete employed by the defendant, after the top air was discontinued.

11. That the Trial Court erred in holding that the prior art for kinetic devices cited was not pertinent for the reason that:

"* * * neither the patent in suit nor the defendants' device are kinetic in operation."

This in the face of the article written by Mr. Kirkland, their Chief Engineer, years before this suit was instituted:

"* * * these portions are carried along in suspension [fol. 433] much as dust is carried in a storm except that the particles are much closer together."

(Defendants' Exhibit H) and also the testimony of defendants' technical and skilled witnesses.

12. The Trial Court erred in failing to apply the law as laid down by the United States Supreme Court in U. S. Concrete Appliance Company vs. Gomery (44 Supreme Court 404), and by the Circuit Court of Appeals of this Circuit in Ransom Concrete Machinery Company vs. United Concrete Company, 177 Fed. 413.

13. The Trial Court erred in not holding that during the prosecution of the McMichael application in the Patent Office it was expanded to include new matter not in the original disclosure.

14. That the Trial Court erred in not holding the patent in suit invalid in view of the testimony of prior public use supported by the documentary evidence of the Journal of Western Society of Engineers for May 1918, Defendants' Exhibit H.

15. That the Trial Court erred in disregarding the testimony of prior public use because "No contemporary sketches are produced * * *" when documentary evi- [fol. 434] dence, Journal of Western Society of Engineers of May 1918, Exhibit H, was produced, and the law in this Circuit, as held by the Circuit Court of Appeals, that no "Contemporary sketches" are necesasry if the Court is satisfied that the witness is competent and is telling the truth:

(a) National Casket Co. vs. Stolts, 157 Fed. 392;
(b) National Casket Co. vs. Stolts, 204 Fed. 983;
(c) Crone vs. Gibson Co., 247 Fed. 503.

16. That the Trial Court erred in not holding the patent invalid.

17. That the Trial Court erred in not holding that the defendants' structure did not infringe the patent in suit.

18. That the Trial Court erred in ordering costs to be taxed against the defendants.

John D. Morgan, Solicitor for Defendants. Alan M. Johnson, Counsel.

[fol. 435] Citation, in usual form, showing service on Stephen J. Cox, omitted in printing.

[fol. 436] In United States District Court

Stipulation as to Record

It is hereby stipulated and agreed between counsel for the parties hereto:

1. That the annexed præcipe shall be the præcipe herein and that the annexed order may be entered forthwith.

2. That the exhibits and portions of the exhibits offered at the hearing, and not specified in the said præcipe shall be treated as physical exhibits for the purpose of avoiding expense of reproduction in the printed transcript of record on appeal, and shall be produced by appellants' counsel at the argument in the Court of Appeals.

3. That appellants' counsel shall also produce and furnish three complete copies of the transcript of the record on appeal in the said Ulen suit (Exhibit D and also containing exhibits 6, 7, 8 and 9 and parts of other exhibits) at the argument in the Appellate court herein, for the use of the Judges thereof.

4. That the transcript of record on appeal herein shall contain the testimony as given at the hearing in the form [fol. 437] of question and answer, and need not be reduced to narrative form, the court approving the same.

Dated, June 6, 1927.

S. J. Cox, Plaintiff's Solicitor. John D. Morgan, Alan M. Johnson, Defendants' Solicitors.

IN UNITED STATES DISTRICT COURT

ORDER AS TO RECORD

And now on this — day of March, 1927, upon motion of the solicitor for defendant, and upon the filing of the attached præcipe indicating the portions of the record to be incorporated in the transcript on appeal which has been taken, and upon the stipulation of the solicitors for the plaintiff and defendants, it is

Ordered, that the portions of the record enumerated in the attached præcipe be incorporated into the transcript on appeal, the exhibits and portions of exhibits not incorporated to be treated as physical exhibits and produced at the argument in the Appellate Court by appellants' counsel, and that the testimony as given at the final hearing need not be reduced to narrative form but may be given in the transcript of record on appeal in the form of question and answer.

F. A. Winslow, U. S. District Judge.

[fol. 438] IN UNITED STATES DISTRICT COURT

[Title omitted]

PRÆCIPE FOR TRANSCRIPT OF RECORD

And now come the defendants, having filed their appeal herein, and hereby designate the following portions of the record to be incorporated into the transcript on the appeal which has been allowed, to wit:

1. Bill of Complaint, as amended by order April 29, 1926.

1a. Order of June 19, 1926, amending answer, and memorandum of Hon. John C. Knox thereon.

2. Answer as amended by order June 19, 1926.

2a. Plaintiff's interrogatories and defendants' answers omitting cuts in exhibits attached thereto (exhibit 3 at hearing being one of them included hereinafter).

[fol. 439] 3. Minutes of the trial in the District Court as agreed upon by counsel.

4. Exhibit No. 1 stipulation providing for uncertified copies of the patent in suit and other patents and also for the use of copies from the Ulen suit without certification, etc.

5. Exhibit No. 2 copy of the patent in suit, No. 1,127,660.

5a. Exhibits 3, 4 and 5.

6. The following patents not in Exhibit D, the Transcript of the Record in the Ulen suit:

122,497, Smith, January 2, 1872.
122,498, Smith, January 2, 1872.
267,318, Beach, November 14, 1882.
408,201, Wallace, July 30, 1889.
599,055, Davidson, February 15, 1898.
873,345, Canniff, December 10, 1907.
958,421, McIlvrid, May 17, 1910.

(It is stipulated that the application for this patent was filed November 2, 1905.)

6a. Pages 13, 102 and 103 of Plaintiff's Exhibit 19, introduced in evidence at the end of the final hearing herein.

7. Opinion of Hon. A. N. Hand, District Judge.

8. Interlocutory decree.

[fol. 440] 9. Stipulation dated March 17, 1927, that final decree may be entered, recovery contingent on decision of U. S. Circuit Court of Appeals.

10. Final decree.

11. Petition for Appeal and Order allowing same.

12. Assignment of Errors.

13. Citation.

14. Præcipe and Order.

15. The amended stipulation.

John D. Morgan, Alan M. Johnson, Defendants' Solicitors.

IN UNITED STATES DISTRICT COURT

STIPULATION AS TO CERTAIN EXHIBITS, ETC.

It is stipulated by and between the respective parties with the consent of the Circuit Court of Appeals, that Defendants' Exhibit D, which is the printed record on appeal in Ulen suit, on appeal to this Court of Appeals, on the same patent, portions of which were put in evidence by the plaintiff in this litigation, need not be again printed, the Court [fol. 441] of Appeals to be provided by the appellants with three copies of said printed record, including those now on file in said Court if available. The official title of said suit is Concrete Mixing and Conveying Company, Plaintiff-Appellee, vs. Ulen Contracting Corporation and Shandaken Tunnel Corporation, Defendants-Appellants.

It is further stipulated, by and between the parties, with the consent of the Court of Appeals, that the file wrapper of the patent in suit and such copies of the prior art and exhibits as are printed in said printed record need not be again printed in the transcript of the record on this appeal on the same patent.

Stephen J. Cox, Solicitor for Plaintiff. John D. Morman, Solicitor for Defendants.

New York, March 28, 1927.

Approved. Martin T. Manton, U. S. Circuit Judge. March 28th, 1927.

[fol. 442] IN UNITED STATES DISTRICT COURT

STIPULATION RE RECORD

It is hereby stipulated and agreed, that the foregoing is a true transcript of the record of the said District Court in the above-entitled matter as agreed on by the parties.

Dated June —, 1927.

John D. Morgan, Attorney for Appellants. Stephen J. Cox, Attorney for Appellees.

[fol. 443] Clerk's certificate to foregoing transcript omitted in printing.

UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SECOND CIRCUIT, OCTOBER TERM, 1927

No. 131

Argued March 6, 1928. Decided July 17, 1928

CONCRETE MIXING & CONVEYING COMPANY, Plaintiff-Appellee,

v.

POWERS-KENNEDY CONTRACTING CORPORATION and ANTHONY G. FLECK, Defendants-Appellants

Appeal from the District Court of the United States for the Southern District of New York

Before Manton, L. Hand, and Swan, Circuit Judges

Appeal from the District Court of the United States for the Southern District of New York.

Suit for infringement of claims Nos. 2, 4, 6, 17, 21, 22, 28, 34, and 35 of patent No. 1,127,660, to McMichael, granted February 9, 1915, for "methods of and apparatus for transporting and treating concrete." The defendant corporation was the builder of the Queensboro Crosstown subway in Forty-Second street, New York City, and used in this work a machine for conveying and placing concrete by compressed air, which is alleged to infringe the patent in suit. The individual defendant furnished the machine to the corporation. From a decree finding the claims valid and infringed, and awarding damages to the plaintiff, the defendants have appealed. Affirmed.

John D. Morgan, of New York City (Alan M. Johnson, of New York City, of counsel), for appellants.

Stephen J. Cox, of New York City (Williams, Bradbury, McCaleb & Hinkle, of Chicago, Ill., of counsel), for appellee.

SWAN, Circuit Judge:

These same claims were held valid and infringed by the same District Judge in Concrete Mixing & Conveying Co. v. Ulen Contracting Corp., 12 F. (2d) 929. We affirmed that decree without opinion. 12 F. (2d) 931. A detailed description of the patent in suit need not be here repeated. Subsequently Judge Bourquin held the patent invalid in Concrete Mixing & Conveying Co. v. R. C. Storrie & Co. (D. C.) 23 F. (2d) 131. It is urged that, because of his decision and the case of Concrete Appliance Co. v. Gomery, 269 U. S. 177, 46 S. Ct. 42, 70 L. Ed. 222, as well as because of new matter introduced in this record, we should reconsider the validity of the patent.

The new matter is, of course, open to us and will be dealt with hereafter. The Supreme Court case, however, contains nothing, in our opinion, which casts doubt upon the correctness of the Ulen decision; in fact, it was before us when that decision was made. It holds, affirming the judgment of the Circuit Court of Appeals for the Third Circuit in 291 F. 486, that the Callahan patent, which covered an apparatus operating on the gravity principle for distributing "wet" concrete, was invalid, because it merely made use of known methods and appliances for the convenient handling of this recently accepted building material. The appellants' argument runs that, since the Supreme Court emphasizes that old apparatus used for distributing water, grain, or coal was readily adaptable for handling concrete, so the prior art patents for blowing sand, grain, or grout, which in the Ulen Case were held not to invalidate McMichael's patent, should now be deemed complete anticipations of it. But the Gomery decision does not rest merely on the assumption that apparatus for coal and grain could have been used for wet concrete without inventive thought. Adaptations of old carriers to handle concrete were shown to have been frequently made for several years before the application for the patent there in suit. The idea was already of common knowledge and was being applied generally. Therefore Callahan's adaptation was not an invention.

But that is a very different situation from the one before us in the Ulen Case, where nobody before McMichael had ever used a pneumatic apparatus to transport concrete. The Warren and Farnham sand-blast machines (patents No. 671,303 and No. 747,396) could not have been so used without increasing the size of the discharge pipes and cutting off the sand-blast nozzles. To do this was to make a new machine, and one who thought of doing it would have had a new and inventive idea; that is, that of blowing concrete, which had not been done before. When that is so, the physical change in the apparatus need be very little to sustain a patent. The only reason why a new use is not patentable is that the law grants patents only for new things, not for new ideas. Similarly Goldie's machine (patent No. 707,840) for blowing cement could not, so far as appears, have been used as it stood for concrete, and never was so used. The Supreme Court case does not require us to reconsider the validity of McMichael's patent.

In the suit against Storrie & Co., Judge Bourquin seems to have relied to some extent, at least, upon patents which were not in the record in the Ulen Case and are not now before us. But whatever the court as now constituted might think of the correctness of our former ruling, it is our duty to follow it, unless new evidence raises questions of the patent's validity not previously considered. See Cortelyou v. Charels E. Johnson & Co., 145 F. 933, 934 (C. C. A. 2); Crier v. Innes, 170 F. 324 (C. C. A. 2).

The new evidence of the patent art upon which appellants rely to distinguish the Ulen decision includes two patents granted in 1872 to W. H. Smith. No. 122,497 is for an improvement in concrete pavements and claims concrete "prepared for use in a liquid or semiliquid condition, capable of flowing in pipes and running into molds." No. 122,498 discloses a machine for mixing liquid concrete and conveying it by a discharge pipe from the mixer to the spot where it is to be laid. The concrete is to flow through the discharge pipe by gravity, or as an alternative, after flowing by gravity through a small winding passage into a chamber, F, is to be forced into the discharge pipe by the passage of steam or compressed air admitted into the chamber above the mass of the concrete. The chamber has a flat bottom of large area relative to the size of the discharge pipe, the outlet of which

opens into the center of the bottom. While this machine discloses the idea of forcing concrete through a pipe by compressed air, whether it was practically operable may well be daubted. It would seem that a large quantity of the concrete, or at least the stones of which it is partly composed, would necessarily accumulate upon the flat bottom of the chamber. In any event, it was very different from McMichael's device, which injects air into the concrete at its entrance into the discharge outlet. It cannot be regarded as an anticipation.

Nor can the argument that the patent in suit is limited to "dry" concrete, as distingushed from defendants' "wet" concrete, prevail. It declares on page 3, line 55: "It is equally well adapted for the treating and handling of a mass containing a considerable excess of water, in case such an excess is for any reason found desirable." The other new references in the Patent Office (Canniff, McElvrid, Beach, and Davidson) we regard as less persuasive than those which were passed upon in the Ulen Case.

The new defense of prior use was held by the District Court not sufficiently proved, and with this we agree. This use was of a machine which Artingstall and Fanning said that they saw laying a concrete floor in 1903, subsequently changing the date to 1904. That was 22 years before they gave their testimony, and there was no documentary corroboration of any kind. It is true that in 1918 Artingstall described very generally before a meeting of engineers that this process was practiced in 1903, but that cannot be deemed documentary corroboration. Fanning says the machine was also used in one section of a tunnel in Chicago in 1903, and was apparently abandoned as too expensive. It is one thing to say that a continuous use to date may be found on oral testimony to have started at a given time, and quite another to say that such testimony is enough when it describes only a casual use, abandoned thereafter, and never entering into the art until after the patent in suit was applied for, an interval of nearly 3 years. Such casual and abandoned uses do not contribute to the stock of knowledge which makes up the art. If we may invalidate a patent upon such prior uses, so proved, no patent would be safe. A prior use, such as constitutes an anticipation, was not proven with the degree of certainty which the courts re-

quire. See Deering v. Winona Harvester Works, 155 U. S. 286, 300, 15 S. Ct. 118, 39 L. Ed. 153; Internat. Cork Co. v. New Process Cork Co. 6 F. (2d) 420, 424 (C. C. A. 2); De Laski & Thropp Co. v. Fisk Rubber Co., 203 F. 986 (C. C. A. 1).

Much argument has been expended in an effort to establish just how the plaintiff's and defendants' machines operate in sending the concrete through the discharge pipe—the plaintiff contending that both discharge it in a succession of slugs or pistons, while the defendants claim that both, or at least theirs, operate kinetically and float the materials in the air, just as sand or grain is carried in floatation. To us the dispute seems irrelevant. The patent says nothing which commits the patentee to the slug method of operation. The theory is built upon the use of the phrase "submasses," as in lines 72 and 89, page 2, where it is said that the lower air jet "engages with the submasses to push them along." But this cannot mean solid "slugs," for on the same page, lines 92-99, the effect is said to be thoroughly to commingle all the ingredients and insure a better mix. Again, at line 113, page 3: "The delivery pipe itself becomes a mixing chamber, wherein pneumatic mixing is effected or continued." And see, also, line 86, page 3. Such statements necessarily forbid the notion of solid slugs. All that is meant by "submasses" is the portions that descend into the discharge pipe, 14, and by their descent are separated from the general mass in the main chamber 1. It is a synonym for "portions of the mass as they move toward and into the discharge duct." Line 53, page 2.

Moreover, several of the claims in suit are for the apparatus, or machine, and if they are infringed it is enough for the purposes of this suit, whether the machine discharges its concrete kinetically or in successive slugs. Neither theory is entirely persuasive. Artingstall's opinion that the inner portion would be blown ahead of that at the circumference of the pipe, which would be retarded by friction, seems sensible. On the other hand, it is difficult to believe that particles of the mixture, including stones of an inch and half in diameter, are floated independently in the air, as sand or grain is blown. Ray's testimony regarding the stones effectively disposes of that possibility under any such pressures as are used. It would seem to us that the

mass as a whole must block the passage of air, forming an obstruction which yields at different points, because of its uneven power of resistance, and that the heavier stones must be carried by the impact and momentum and cohesion of the lighter substances, the whole mass going forward in a constantly agitated mixed stream, just as McMichael describes. But whether the concrete goes forward as we imagine, or in some other manner, there is no sufficient reason to suppose that defendants' machine does not operate in the same manner as plaintiff's, whatever that manner may be. The District Court on conflicting evidence found infringement of the method claims (4 and 6), as well as of the apparatus claims. We are not convinced that this finding was wrong.

Apparently the "slug" theory was brought into the argument because it was thought necessary to distinguish in this way from Farnham, Warren, and Goldie. We have already suggested that those machines would require modifications to operate with concrete containing stones an inch and a half in diameter. Whether this was the ground adopted to distinguish them in the Ulen Case, or whether the court as then constituted accepted the slug theory, does not appear, and is not important. On some ground we distinguished the prior art, and sustained the validity of the patent, and that ruling we should follow, until its error is pointed out by higher authority.

It is urged that the defendants' structure and operation are different, in that (1) they do not use "dry," air-impervious concrete; (2) they do not put compressed air pressure behind the concrete mass; (3) they do not use a second compressed air stream at the bottom of the chamber, to break the dry concrete into slugs; and (4) they do not push the concrete through the delivery pipe in "slugs" by air pressure from behind.

We have already alluded to a portion of the specifications which indicates that the patent is not limited to "dry" concrete. It is true that the defendants' machine in its present form, whether or not this was so when the suit was started, is operated without an air inlet into the discharge chamber above the mass of concrete. But it is admitted by defendants' witnesses that, as soon as air is injected into the dis-

charge pipe, it is forced through the concrete and establishes a pressure in the chamber above. Mr. Ray, plaintiff's expert, testified that, because of this, the operation without the top air inlet is identically the same for all practical purposes as with the top inlet. While the claims which specify an upper air inlet (e. g., claims 2, 17, 34, and 35) might not be infringed by a machine which omits it, the other claims in suit make no reference to the upper air inlet. We think there is clearly infringement of claims 4, 6, 21, 22, and 28. The final decree appealed from awards money damages, and is sustainable on the infringement of these claims, even though other claims in suit were not infringed by the machine used by defendants at the time of the trial.

The decree is accordingly affirmed.

Manton, Circuit Judge, dissents.

UNITED STATES CIRCUIT COURT OF APPEALS, SECOND CIRCUIT

At a stated term of the United States Circuit Court of Appeals in and for the Second Circuit, held at the court-rooms, in the Post Office building, in the city of New York, on the 24th day of July, one thousand nine hundred and twenty-eight.

Present: Hon. Martin T. Manton, Hon. Learned Hand, Hon. Thomas W. Swan, Circuit Judges.

CONCRETE MIXING AND CONVEYING COMPANY,
Plaintiff-Appellee,

v.

POWERS KENNEDY CONTRACTING CORPORATION and Another,
Defendants-Appellants

Appeal from the District Court of the United States for the Southern District of New York

This cause came on to be heard on the transcript of record from the District Court of the United States for the Southern District of New York and was argued by counsel.

On consideration whereof it is now hereby ordered, adjudged, and decreed that the decree of said District Court be, and it hereby is, affirmed with costs.

It is further ordered that a Mandate issue to the said District Court in accordance with this decree.

L. H., T. W. S.

[Endorsed:] United States Circuit Court of Appeals, Second Circuit. Concrete Company v. Powers Kennedy Co. Order for mandate. United States Circuit Court of Appeals, Second Circuit. Filed Jul. 24, 1928. William Parkin, Clerk.

UNITED STATES CIRCUIT COURT OF APPEALS, SOUTHERN DISTRICT OF NEW YORK

I, William Parkin, Clerk of the United States Circuit Court of Appeals for the Second Circuit, do hereby certify that the foregoing pages, numbered from 1 to 449, inclusive, contain a true and complete transcript of the record and proceedings had in said Court in the case of Concrete Mixing and Conveying Company, Plaintiff-Appellee, against Powers Kennedy Contracting Corporation and another, Defendants-Appellants, as the same remain of record and on file in my office.

In testimony whereof I have caused the seal of the said court to be hereunto affixed, at the City of New York, in the Southern District of New York, in the Second Circuit, this 8th day of October, in the year of our Lord one thousand nine hundred and twenty eight, and of the Independence of the said United States the one hundred and fifty-third.

Wm. Parkin, Clerk. [Seal United States Circuit Court of Appeals, Second Circuit.]

[fol. 451] SUPREME COURT OF THE UNITED STATES

ORDER ALLOWING CERTIORARI—Filed December 10, 1928

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Second Circuit is granted. And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ, the case to be heard with No. 528 as one case.

Endorsed on cover: File No. 33,810. U. S. Circuit Court of Appeals, Second Circuit. Term No. 501. Powers-Kennedy Contracting Corporation and Anthony G. Fleck, petitioners, vs. Concrete Mixing and Conveying Company. Petition for writ of certiorari and exhibit thereto. Filed October 15th, 1928. File No. 33,810.